INSTRUCTION BOOK

for

Signal Generator Set AN/URM-27

Manufactured by

NEW LONDON INSTRUMENT COMPANY

ORDER NO. 15743-Phila-50-7

22 February 1951

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WARNING

HIGH VOLTAGE

is used in the operation of
this equipment.

DEATH ON CONTACT

may result if operating personnel
fail to observe safety precautions.

First Aid for Electric Shock

RESCUE.

In case of electric shock, shut off the high voltage at once and ground the circuits. If the high voltage cannot be turned off without delay, free the victim from contact with the live conductor as promptly as possible. Avoid direct contact with either the live conductor or the victim's body. Use a dry board, dry clothing, or other nonconductor to free the victim. An ax may be used to cut the high-voltage wire. Use extreme caution to avoid the resulting electric flash.

SYMPTOMS.

a. Breathing stops abruptly in electric shock if the current passes through the breathing center at the base of the brain. If the shock has not been too severe, the breath center recovers after a while and normal breathing is resumed, provided that a sufficient supply of air has been furnished meanwhile by artificial respiration.

b. The victim is usually very white or blue. The pulse is very weak or entirely absent and unconsciousness is complete. Burns are usually present. The victim's body may become rigid or stiff in a very few minutes. This condition is due to the action of electricity and is not to be considered rigor mortis. Artificial respiration must still be given, as several such cases are reported to have recovered. The ordinary and general tests for death should never be accepted.

TREATMENT.

a. Start artificial respiration immediately. At the same time send for a medical officer, if assistance is available. Do not leave the victim unattended. Perform artificial respiration at the scene of the accident, unless the victim's or operator's life is endangered from such action. *In this case only*, remove the victim to another location, but no farther than is necessary for safety. If the new location is more than a few feet away, artificial respiration should be given while the victim is being moved. If the method of transportation prohibits the use of the Shaeffer prone pressure method, other methods of resuscitation may be used. Pressure may be exerted on the front of the victim's diaphragm, or the direct mouth-to-mouth method may be used. Artificial respiration, once started, must be continued, without loss of rhythm.

b. Lay the victim in a prone position, one arm extended directly overhead, and the other arm bent at the elbow so that the back of the hand supports the head. The face should be turned away from the bent elbow so that the nose and mouth are free for breathing.

c. Open the victim's mouth and remove any foreign bodies, such as false teeth, chewing gum, or tobacco. The mouth should remain open,

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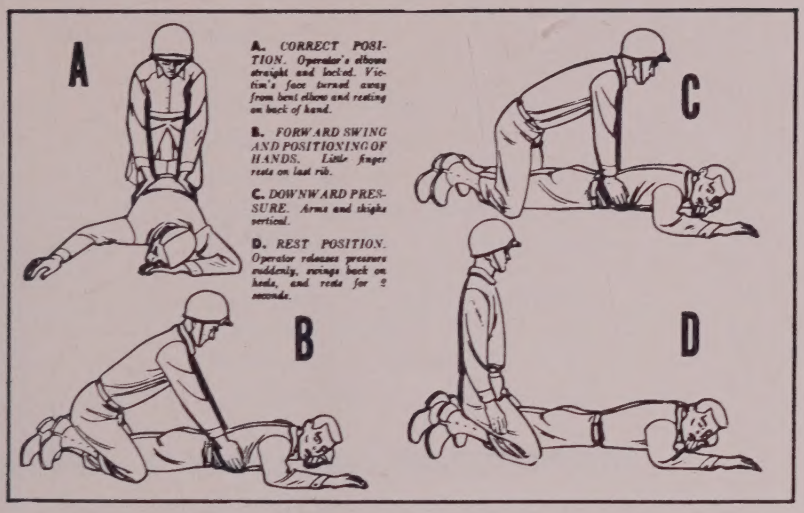

A
B
C
D
A. CORRECT POSITION. Operator's elbows straight and locked. Victim's face turned away from bent elbow and resting on back of hand.
B. FORWARD SWING AND POSITIONING OF HANDS. Little finger rests on last rib.
C. DOWNWARD PRESSURE. Arms and thighs vertical.
D. REST POSITION. Operator releases pressure suddenly, swings back on heels, and rests for 2 seconds.

with the tongue extended. Do not permit the victim to draw his tongue back into his mouth or throat.

d. If an assistant is available during resuscitation, he should loosen any tight clothing to permit free circulation of blood and to prevent restriction of breathing. He should see that the victim is kept warm, by applying blankets or other covering, or by applying hot rocks or bricks wrapped in cloth or paper to prevent injury to the victim. The assistant should also be ever watchful to see that the victim does not swallow his tongue. He should continually wipe from the victim's mouth any frothy mucus or saliva that may collect and interfere with respiration.

e. The resuscitating operator should straddle the victim's thighs, or one leg, in such manner that:

(*1*) the operator's arms and thighs will be vertical while applying pressure on the small of the victim's back;

(*2*) the operator's fingers are in a natural position on the victim's back with the little finger lying on the last rib;

(*3*) the heels of the hands rest on either side of the spine as far apart as convenient without allowing the hands to slip off the victim;

(*4*) the operator's elbows are straight and locked.

f. The resuscitation procedure is as follows:

(*1*) Exert downward pressure, not exceeding 60 pounds, for 1 second.

(*2*) Swing back, suddenly releasing pressure, and sit on the heels.

(*3*) After 2 seconds, swing forward again, positioning the hands exactly as before, and apply pressure for another second.

g. The forward swing, positioning of the hands, and the downward pressure should be accomplished in one continuous motion, which requires 1 second. The release and backward swing require 1 second. The addition of the 2-second rest makes a total of 4 seconds for a complete cycle. Until the operator is thoroughly familiar with the correct cadence

Contents

	Paragraph	Page
CHAPTER 1. INTRODUCTION.		
Section I. General.		
Scope	1	1
Forms and records	2	1
II. Description and data.		
Purpose and use	3	1
Technical characteristics	4	2
Packaging data	5	3
Table of components	6	3
Description of Signal Generator Set AN/URM-27	7	5
Description of minor components	8	5
CHAPTER 2. OPERATING INSTRUCTIONS.		
Section I. Service upon receipt of Signal Generator Set AN/URM-27.		
Siting	9	6
Unpacking, uncrating, and checking new equipment	10	6
Installation of Signal Generator Set AN/URM-27	11	6
Service upon receipt of used or reconditioned equipment	12	7
II. Controls and instruments.		
General	13	7
Controls and their function	14	7
III. Operation under usual conditions.		
Starting procedure	15	9
Operation	16	9
Stopping procedure	17	9
IV. Operation under unusual conditions.		
General	18	11
Operation in arctic climates	19	11
Operation in tropical climates	20	11
Operation in desert climates	21	11
CHAPTER 3. ORGANIZATIONAL MAINTENANCE INSTRUCTIONS.		
Section I. Preventative maintenance services.		
Tools and materials required	22	12
Definition of preventive maintenance	23	12

	Paragraph	Page
General preventive maintenance techniques	24	12
Performing preventive maintenance	25	12
II. Weatherproofing and lubrication.		
Lubrication	26	13
Weatherproofing	27	13
Rustproofing and painting	28	13
III. Trouble shooting at organizational maintenance level.		
Scope	29	13
Visual inspection	30	14
Trouble shooting by using equipment performance checklist	31	14
Equipment performance checklist	32	14
CHAPTER 4. THEORY.		
Block diagram	33	16
Audio oscillator	34	18
Audio amplifier	35	19
R-f oscillator	36	19
Output attenuator	37	21
Modulation switch	38	21
Selenium rectifier	39	22
Voltage regulator circuit	40	23
Variable resistance stage	41	24
R-f output cables	42	26
CHAPTER 5. FIELD MAINTENANCE INSTRUCTIONS.		
Section I. Trouble shooting at field maintenance level.		
Trouble-shooting procedures	43	27
Trouble-shooting data	44	28
Test equipment required for trouble shooting	45	29
General precautions	46	29
Power supply test	47	30
Operational test	48	32
Trouble-shooting chart	49	32
D-c resistances of transformers and coils	50	33
II. Repairs.		
Removing r-f cavity from panel	51	34
Dismantling r-f cavity	52	34
Rethreading mask cord drive	53	36
Removing r-f oscillator tube	54	36
Removing r-f crystal (CR4)	55	36
Disassembly of tuning mechanism	56	36
Refinishing	57	37

	Paragraph	Page
III. Calibration procedures.		
Test equipment required	58	37
R-f oscillator tuning calibration	59	37
KC DEVIATION calibration	60	38
Output attenuation calibration	61	38
IV. Final testing.		
General	62	39
Test equipment required	63	39
Voltage and resistance tests	64	39
Final testing operations	65	39

CHAPTER 6. SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE.

Section I. Shipment and limited storage.		
Disassembly	66	40
Repacking for shipment or limited storage	67	40
II. Demolition of material to prevent enemy use.		
General	68	40
Methods of destruction	69	40

APPENDIX I. REFERENCES 43

II. IDENTIFICATION TABLE OF PARTS 45

INDEX 52

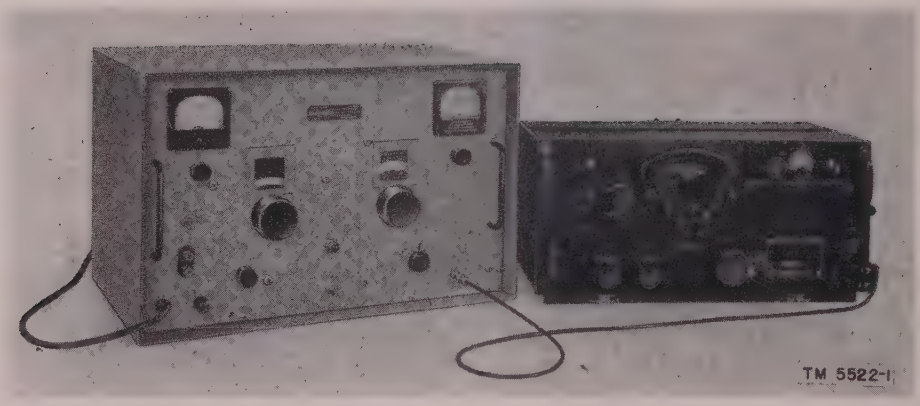


Figure 1. Signal Generator Set AN/URM-27, typical application.

Note. This instruction book will be replaced by TM11-5522 which, when published, will be listed in SR 310-20-4.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

This technical manual contains instructions for the installation, operation, maintenance, and repair of Signal Generator Set AN/URM-27. In addition to these instructions there are two appendixes covering a list of references and an identification table of parts.

2. Forms and Records

The following standard forms will be used for reporting unsatisfactory conditions of materiel and equipment, or improper preservation, packaging, packing, marking, loading, stowage, or handling thereof.

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745-45-5 (Army) and NAV DEPT SERIAL 85POO (Navy).

b. DA AGO Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer, as prescribed in SR 700-45-5.

c. DA AGO Form 419, Preventive Maintenance Checklist for Signal Corps Equipment, will be prepared in accordance with the instructions on the back of the form.

d. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

a. Signal Generator Set AN/URM-27 is a 7-tube f-m (frequency-modulated) signal generator. This equipment is used for testing the bandwidth, alinement, and sensitivity of frequency-modulated receivers (fig. 1).

b. The frequency range of Signal Generator Set AN/URM-27 is from 18 to 109 mc (megacycles). The r-f (radio-frequency) carrier can be unmodulated, modulated by the internal source at 400 cps (cycles per second) or 1000 cps, or modulated by an external source. Functionally, the signal generator set consists of the following:

(1) An audio oscillator that produces a sine wave oscillation at either 400 or 1,000 cps.

(2) An audio amplifier which amplifies the audio signal.

(3) An r-f (radio-frequency) oscillator which produces an r-f output from 18 to 109 mc.

(4) A power supply which furnishes regulated power to the signal generator set.

(5) A variable resistance tube whose output voltage is adjusted automatically by the r-f oscillator voltage control.

(6) An output attenuator that provides a calibrated output from the signal generator set.

c. A typical application of Signal Generator Set AN/URM-27 is shown in figure 1.

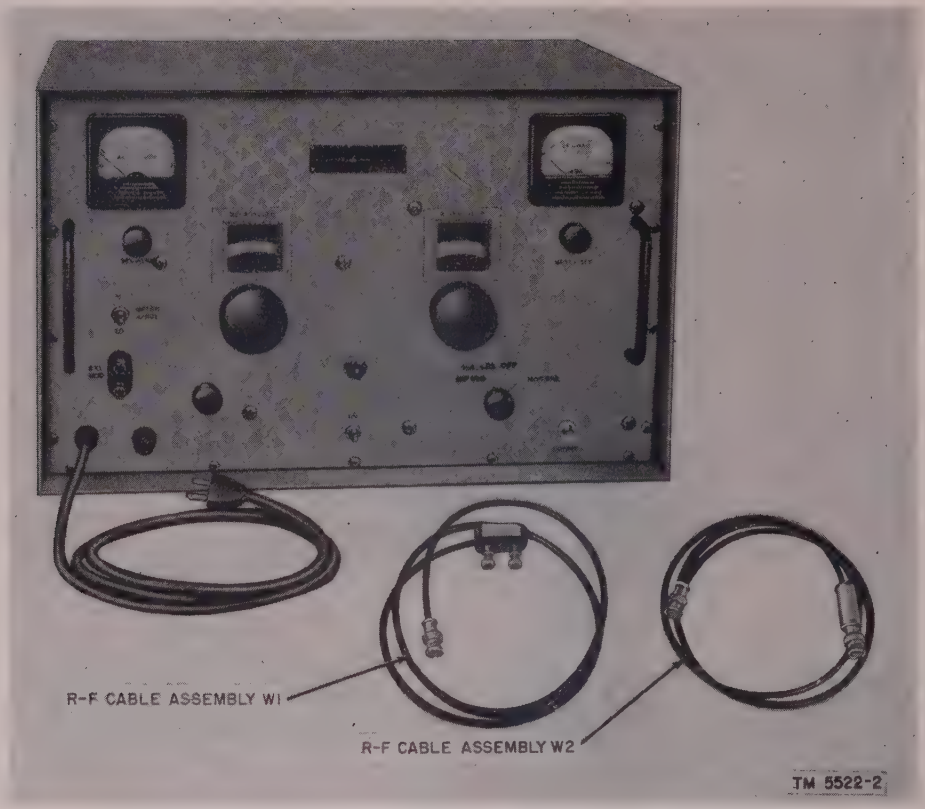


Figure 2. Signal Generator Set AN/URM-27, with accessories.

4. Technical Characteristics

Frequency range	18 to 109 mc. ±½% + .2 mc.
Types of output	modulated or unmodulated.
Frequencies of internal modulation	400 or 1,000 cps.
A-f (audio-frequency) range for external modulation	100 to 10,000 cps.
Output power (controlled by calibrated attenuator)	R-f cable assembly W1: .1 volt to .1 μv (microvolt) (-37 to -157 db (decibels) below 1 watt into 50 ohms). R-f cable assembly W2: .02 volt to .02 μv (-44 to -164 db below 1 watt into 10 ohms).
Attenuator accuracy	±10%.
Frequency deviation (continuously adjustable, two ranges)	0 to 30 kc (kilocycles) or 0 to 150 kc ±5% of full scale reading at 1000 cycles.
Output impedance using r-f cable assembly W1	25 ohms ±3 ohms at 50 mc.
Output impedance using r-f cable assembly W2	9 ohms ±1 ohm at 50 mc.
Number of tubes	7.
Types of tubes:	
Audio oscillator	6BJ6.
Audio amplifier	6AQ5.
R-f oscillator	12AU7.
Regulator variable resistance	6AV5.
D-c (direct-current) amplifier	6BH6.
Voltage regulator	5651.
Variable resistance	6AS5.
A-c (alternating-current) line voltage input	115 volts ac, 50 to 60 cps.
Weight	45 lbs.

5. Packaging Data

When packaged for domestic shipment, Signal Generator Set AN/URM-27 with its cables is blocked and cushioned with corrugated fiberboard within a close-fitting corrugated fiberboard box, and then, it is sealed with gummed Kraft tape. This package is boxed in a wooden crate 21 inches high, 28 inches wide, and 21 inches deep with a 2-inch layer of excelsior between the fiberboard box and the wooden crate. The total weight of the crate, when packed, is approximtaely 55 pounds.

6. Table of Components

The following table lists the physical dimensions of the components for this equipment:

Component	Required No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu. ft.)	Unit weight (lbs.)
Signal Generator Set AN/URM-27	1	13-1/8	12-5/16	19-3/8	2.2	45
R-f cable assembly W1	1			36		.5
R-f cable assembly W2	1			36		.5

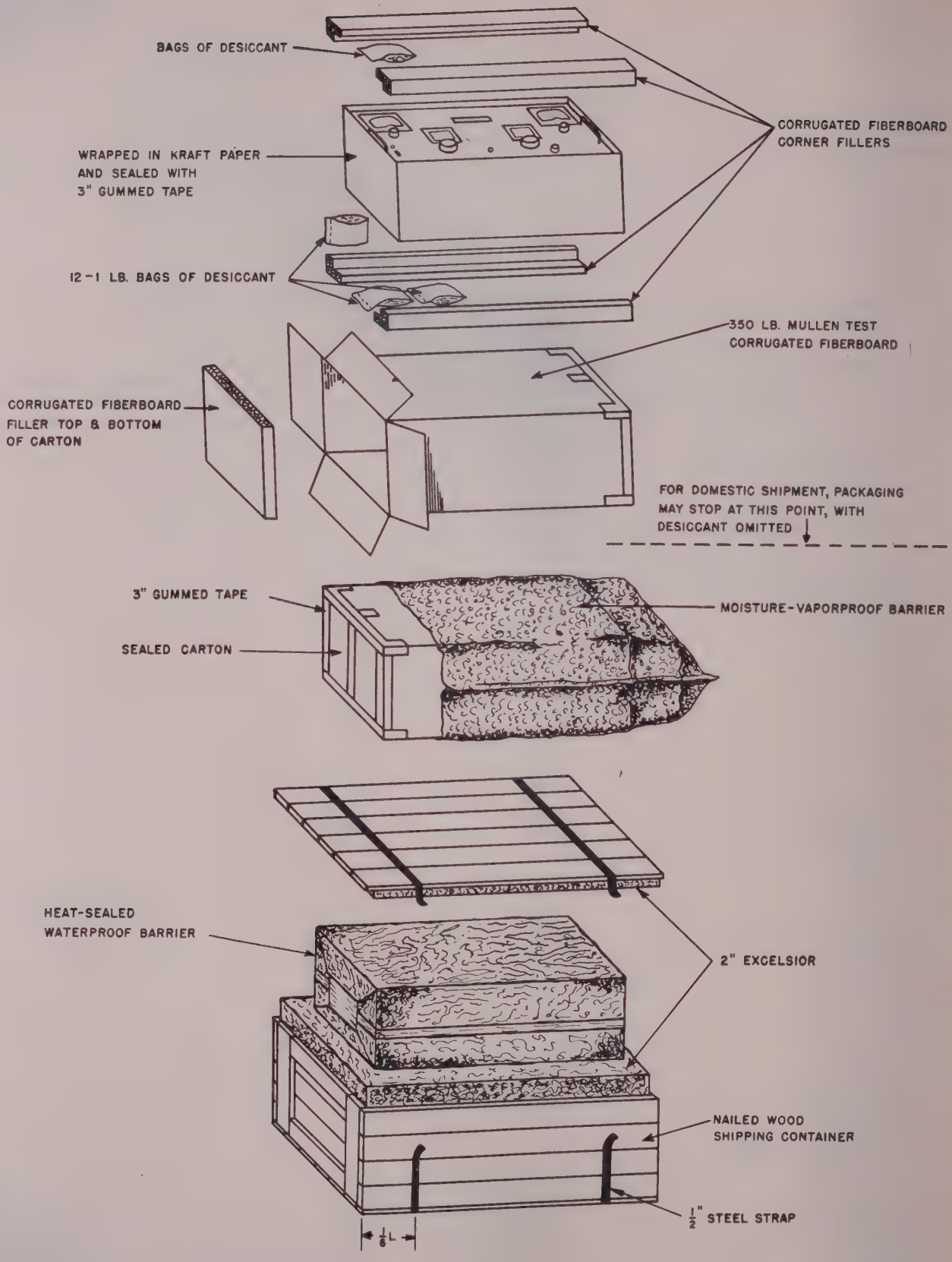

BAGS OF DESICCANT
CORRUGATED FIBERBOARD CORNER FILLERS
WRAPPED IN KRAFT PAPER AND SEALED WITH 3" GUMMED TAPE
12 - 1 LB. BAGS OF DESICCANT
350 LB. MULLEN TEST CORRUGATED FIBERBOARD
CORRUGATED FIBERBOARD FILLER TOP & BOTTOM OF CARTON
FOR DOMESTIC SHIPMENT, PACKAGING MAY STOP AT THIS POINT, WITH DESICCANT OMITTED
3" GUMMED TAPE
MOISTURE-VAPORPROOF BARRIER
SEALED CARTON
HEAT-SEALED WATERPROOF BARRIER
2" EXCELSIOR
NAILED WOOD SHIPPING CONTAINER
½" STEEL STRAP
⅙L
TM 5522-3

Figure 3. Signal Generator Set AN/URM-27, packaging diagram.

7. Description of Signal Generator Set AN/URM-27

a. Signal Generator Set AN/URM-27 is portable equipment and is housed in a gray finished steel cabinet 13⅛ inches high, 19⅜ inches wide, and 12-5/16 inches deep. The front panel contains all the operating controls and is fastened to the cabinet with 18 screws. The panel also contains two meters. One meter indicates the frequency deviation; the other is used to calibrate the output attenuator.

b. The power cord, for connection to 115 volts, 50 to 60 cycles, enters the panel at the lower left-hand corner. A pair of binding posts is mounted on the front panel for connecting a source of external modulation to the signal generator set; the lower binding post is the ground terminal. Two handles protruding from the panel permit convenient removal of the signal generator set from the cabinet.

8. Description of Minor Components

a. R-F Cable Assembly W1. This cable assembly consists of Radio Frequency Cable RG-58A/U, Radio Frequency Plug UG-88/U, and a box (with two binding posts) which contains a 51-ohm resistor.

b. R-F Cable Assembly *W2*. This cable assembly consists of Radio Frequency Cable RG-58A/U, Radio Frequency Plug UG-88/U, and a box which contains a 39-ohm resistor and a 10-ohm resistor.

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. Service Upon Receipt of Signal Generator Set AN-URM-27

9. Siting

A power receptacle to supply 115 volts, 50 to 60 cycles, should be located within 6 feet of Signal Generator Set AN/URM-27. The equipment under test should be located within 3 feet of the signal generator set.

10. Uncrating, Unpacking, and Checking New Equipment

Note. For used or reconditioned equipment, refer to paragraph 12.

a. GENERAL Equipment may be shipped in overseas packing cases or in domestic packing cases. When new equipment is received, select a location where the equipment may be unpacked without exposure to the elements and which is convenient to the permanent or semipermanent installation of the equipment. The instructions in subparagraph b below apply to equipment shipped in export packing cases, and the instructions in subparagraph f apply to equipment in domestic packing cases.

CAUTION: Be careful in uncrating, unpacking, and handling the equipment; it is easily damaged. If it becomes damaged or exposed, the equipment will be useless. A complete overhaul may be required.

b. STEP-BY-STEP INSTRUCTIONS FOR UNCRATING AND UNPACKING EXPORT SHIPMENTS (FIG. 3).

(1) Place the packing case as near the operating position as is convenient.
(2) Cut and fold back the steel straps.
(3) Remove the nails with a nail puller. Remove the top and one side of the packing case. Do not attempt to pry off the sides and top; the equipment may become damaged.
(4) Remove the moistureproof barrier and any excelsior or corrugated paper covering the equipment inside the case.
(5) Remove the equipment from its inner case and place it on the workbench or near its final location.
(6) Inspect the equipment for possible damage incurred during shipment.
(7) Check the contents of the packing case against the master packing slip.

c. OPENING THE CARDBOARD CARTON AND WATERPROOF BARRIER. No special instructions are needed for opening the waterproof barrier and removing the equipment from the cardboard carton.

d. CHECKING. Check the contents against the master packing slip.

e. UNPACKING DOMESTIC PACKING CASES. Test equipment may be received in domestic packing cases. The instructions given in subparagraph b above also apply to unpacking domestic shipments. Cut the metal bands. Open the cartons that protect the equipment; or, if heavy wrapping paper has been used, remove it carefully and take out the equipment. Check the contents of the packing cases against the master packing slip.

Note. Save the original packing cases and containers for both export and domestic shipments. They can be used again when the equipment is repacked for storage or shipment.

11. Installation of Signal Generator Set AN/URM-27

Signal Generator Set AN/URM-27 is complete in one portable unit and is ready for use upon delivery. No permanent or special installation procedures are necessary. Upon delivery the signal generator set should be checked to make sure that no damage occurred during shipment. However, the following steps must be taken before operation:

a. Connect the power cable into a 115 volt, 50 to 60 cycle a-c power source.

b. If an output voltage range of .1 volt to .1 μv (microvolt) is desired, connect r-f cable assembly W1 to OUTPUT jack J3, located on the right side of the signal generator set.

c. If an output voltage range of .02 volt to .02 μv is desired, connect r-f cable assembly W2 to J3.

12. Service Upon Receipt of Used or Reconditioned Equipment

a. Follow the instructions in paragraph 10 for uncrating, unpacking, and checking the equipment.

b. Check the used or reconditioned equipment for tags or other indications pertaining to changes in the wiring of the equipment. If any changes in wiring have been made, note the change in this manual, preferably on the schematic diagram (fig. 27).

c. Check the operating controls for ease of rotation.

d. Perform the installation and connection procedures listed in paragraph 11.

Section II. CONTROLS and INSTRUMENTS

13. General

Haphazard operation or improper setting of the controls can cause damage to electronic equipment. For this reason it is important to know the function of every control. The actual operation of the equipment is discussed in section III in this chapter.

14. Controls and Their Function (fig. 4)

a. The following table lists the controls of Signal Generator Set AN/URM-27 and indicates their function:

Control	Function
MEGACYCLES tuning control	Controls the r-f output frequency of the signal generator set by varying both the oscillator tank capacitance and inductance. The tuning dial is calibrated in mc.
ATTENUATION control	Controls output voltage of signal generator. The ATTENUATION dial is calibrated in μv.
Modulation switch (S1)	Permits selection of internal modulation at 400 or 1,000 cps, or external modulation. In the OFF position, the carrier is unmodulated.
DEVIATION control (R13)	Controls frequency deviation of r-f oscillator. The meter directly above this control indicates the frequency deviation in kc.
HI-LO METER RANGE switch (S3)	Selects KC DEVIATION meter range. In LO position, the meter reads a maximum frequency deviation of 30 kc. In HI position, maximum deviation is 150 kc.
METER SET control (R33)	Adjusts plate voltage of r-f oscillator tube V3. Before taking a reading on the ATTENUATION dial, this control must be adjusted so that the pointer of the RF OUTPUT meter coincides with the red line.
Power ON switch (S2)	Connects the signal generator set to a-c power source when in ON position.
Fine tuning control	Permits fine adjustment of r-f oscillator frequency; located below and to the left of the MEGACYCLES tuning control.

b. The following controls are inside the cabinet and are preset screw driver slot type potentiometers:

Control	Function
R-f meter calibration (R36)	Calibrates RF OUTPUT meter (par. 61).
Voltage set (R29)	Controls output voltage of regulated power supply.
Hi meter set (R17)	Limits current through deviation meter in HI position of METER RANGE switch (par. 60).
Lo meter set (R18)	Limits current through deviation meter in LO position of METER RANGE switch (par. 60). *Note.* Always adjust LO range before adjusting HI range. HI range setting is affected by LO range control.
R-f oscillator trimmer (C14)	Adjusts frequency of r-f oscillator (par. 59).

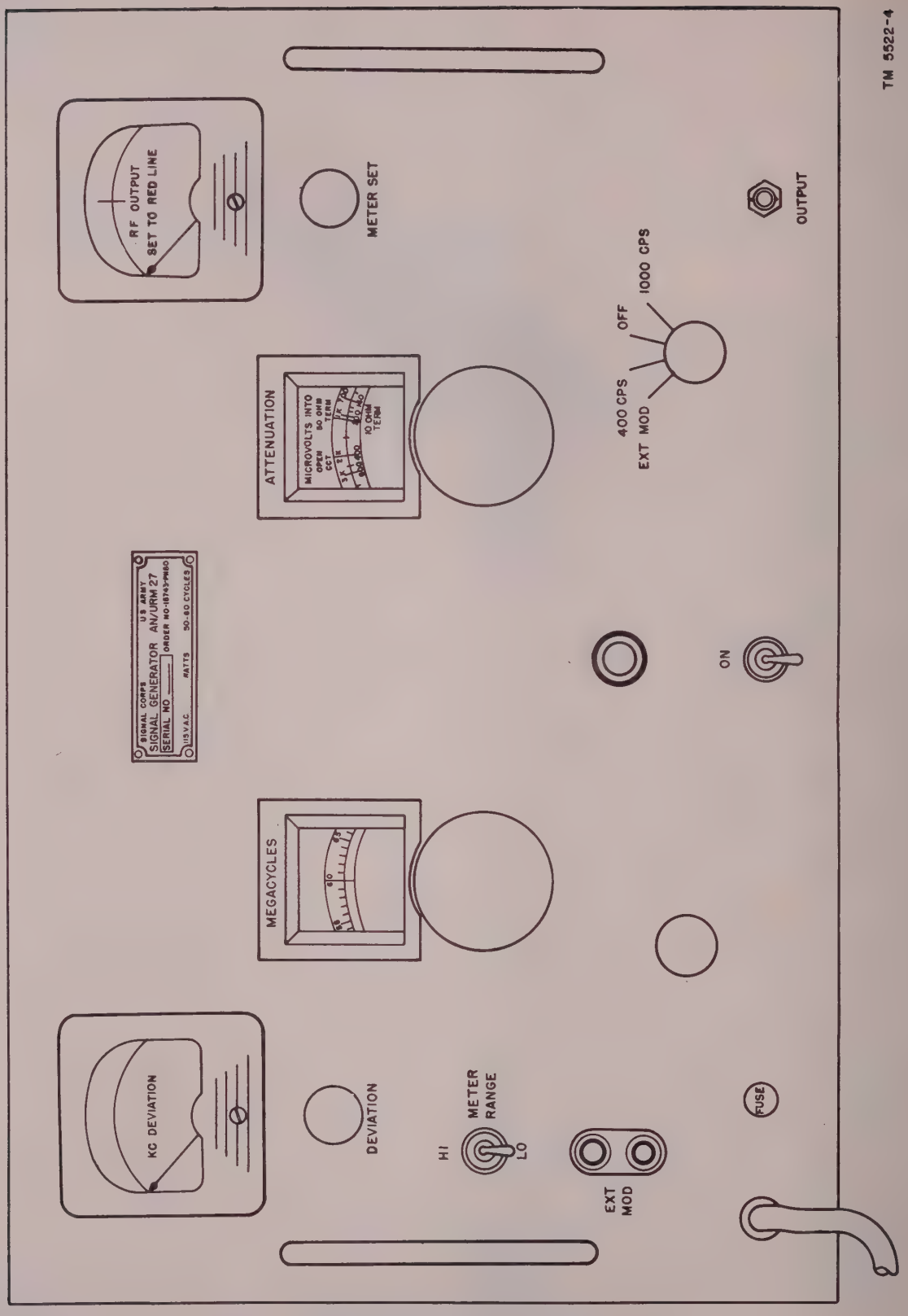


Figure 4. Signal Generator Set AN/URM-27, front view.

Section III. OPERATION UNDER USUAL CONDITIONS

CAUTION: Before using Signal Generator Set AN/URM-27 read the instructions covering its use. It is a precision instrument and must be handled with care. When the equipment is not in use, the power switch must be in the off position.

15. Starting Procedure

a. PRELIMINARY. Set the front panel controls (fig. 4) as follows:

Control	Function
DEVIATION	Full counterclockwise position.
METER SET	Full counterclockwise position.
Modulation switch	Off.
Power switch	Off.
METER RANGE switch	HI.

b. STARTING. Connect the power cable to the a-c power source. Turn on the signal generator set by throwing the power switch to the ON position. Allow at least one-half hour for warm-up.

16. Operation

a. Rotate the MEGACYCLES tuning dial to the desired frequency. Use the fine tuning control for fine adjustment.

b. Turn METER SET control until pointer on r-f meter coincides with red line.

c. Set modulation switch to desired modulating frequency.

d. Throw METER RANGE switch to LO for deviation from 0 to 30 kc and to HI for deviation from 0 to 150 kc.

CAUTION: Do not throw switch from HI to LO without returning DEVIATION control to minimum position.

e. Adjust DEVIATION control to required frequency deviation on KC DEVIATION Meter.

f. The r-f output now can be set by means of the ATTENUATION dial, which is calibrated in μv (fig. 5).

g. The actual voltage applied (E_L) to the load is not necessarily the same as the voltage indicated (E_{IND}) on the ATTENUATION dial (par. 42). To determine E_L in μv, refer to the following table:

Cable	Load Impedance Z_L	E_L
R-f cable assembly W1	Greater than 250 ohms	$E_L = E_{IND}$
(Use 50-ohm calibrating hairline.)	Less than 250 ohms	$E_L = \frac{Z_L}{Z_L + 25.5} \times E_{IND}$
R-f cable assembly W2	Greater than 100 ohms	$E_L = E_{IND}$
(Use 10-ohm calibrating hairline.)	Less than 100 ohms	$E_L = \frac{Z_L}{Z_L + 9} \times E_{IND}$

17. Stopping Procedure

When the equipment is to be removed from service,

a. Throw power switch to off position.

b. Reset all controls as in paragraph 15a.

c. Remove power cord from power source.

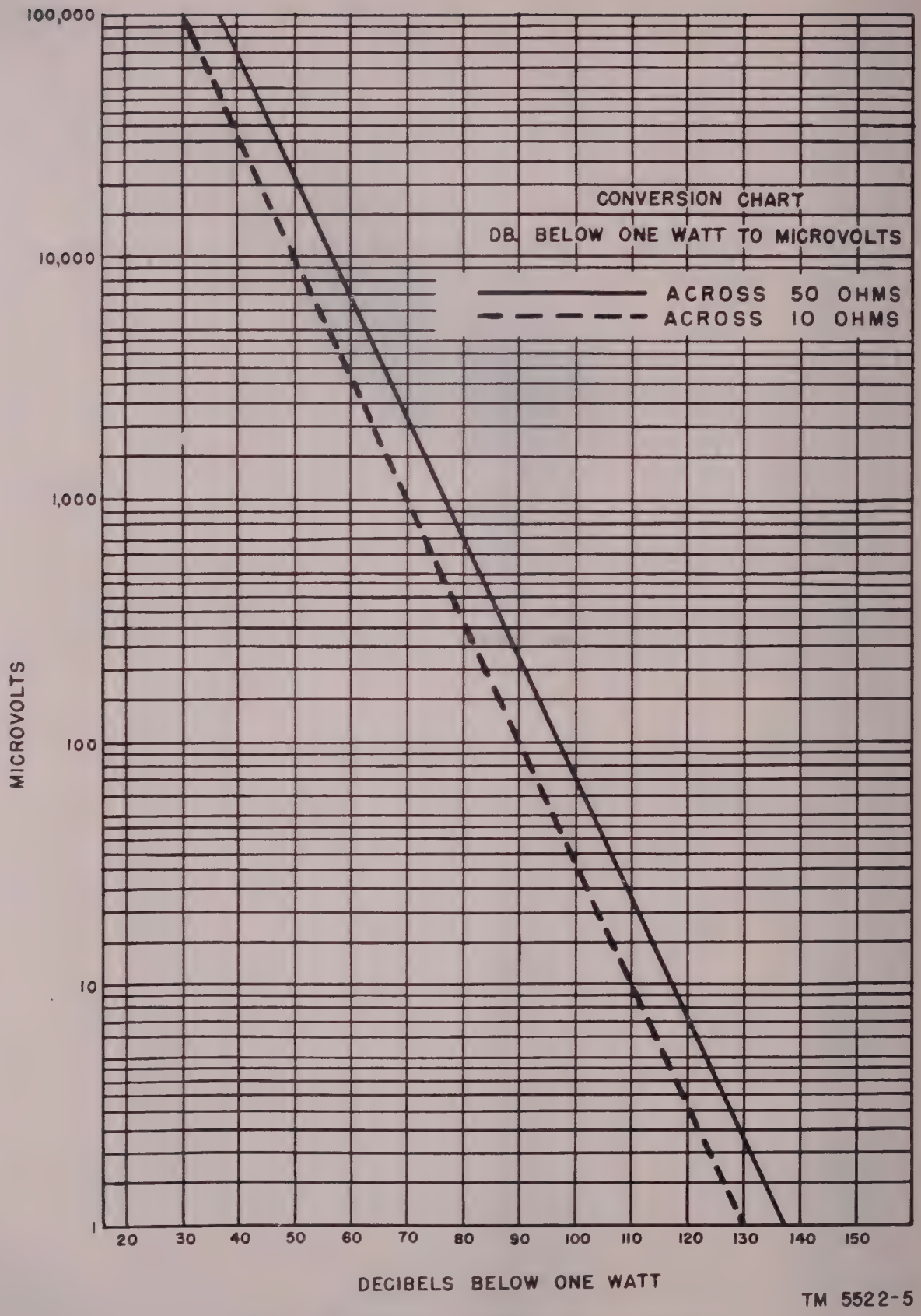


Figure 5. Conversion chart, db below 1 watt to microvolts.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

18. General

The operation of Signal Generator Set AN/URM-27 may be difficult in regions where extreme cold, heat, humidity and moisture, sand conditions, etc., prevail. In the following paragraphs, instructions are given on procedures for minimizing the effect of these unusual operating conditions.

19. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather affect the efficient operation of the equipment. Instructions and precautions for operation under such adverse conditions follows:

a. Handle the equipment carefully.

b. Keep the equipment warm and dry. If the set is not in a heated inclosure, construct an insulated box for the set.

c. Locate the equipment inside a heated inclosure where there is no danger of a cold draft striking the glass tubes when a door is opened. A sudden draft of cold air is often sufficient to shatter the glass envelope of a heated tube. If the inclosure is constructed so that this precaution is impossible, place a blanket or some barrier between the source of the draft and the equipment.

d When equipment which has been exposed to cold is brought into a warm room, it will start to sweat and will continue to do so until it reaches room temperature. Dry it thoroughly. This condition also arises when equipment warms up during the day after exposure during a cold night.

20. Operation in Tropical Climates

When operated in tropical climates, radio equipment may be installed in tents, huts, or, when necessary, in underground dugouts. When equipment is installed below ground and when it is set up in swampy areas, moisture conditions are more acute than normal in the tropics. Ventilation is usually very poor, and high relative humidity causes condensation of moisture on the equipment whenever the temperature of the equipment becomes lower than the ambient air. To minimize this condition, place lighted electric bulbs under the equipment.

21. Operation in Desert Climates

a. Conditions similar to those encountered in tropical climates often prevail in desert areas. Use the same measures to insure proper operation of the equipment.

b. The main problem which arises with equipment operation in desert areas is the large amount of sand, dust, and dirt which enters the moving parts of the equipment, such as dial drives and gearing mechanisms. The ideal preventive precaution is to house the equipment in a dustproof shelter. Since, however, such a building is seldom available and would require air conditioning, the next best precaution is to make the building in which the equipment is located as dustproof as possible with available materials. Hang wet sacking over the windows and doors, cover the inside walls with heavy paper, and with sand secure the side walls to prevent their flapping in the wind.

c. Never tie power cords, signal cords, or other wiring connections to either the inside or outside of tents. Desert areas are subject to sudden wind squalls which may jerk the connections loose or break the lines.

d. Be careful to keep the equipment as free from dust as possible. Make frequent preventive maintenance checks (ch. 3). Excessive amounts of dust, sand, or dirt may result in grit which will damage the equipment.

CHAPTER 3
ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. PREVENTIVE MAINTENANCE SERVICE

22. Tools and Materials Required

Tools and materials required for organizational maintenance of Signal Generator Set AN/URM-27 are listed below with stock numbers.

a. TOOLS.

1—3/8-7/16-inch double open end wrench, TL-477/U, 6R55512-14.1.
1—9/16-5/8-inch double open end wrench, 6R55565.
1—1-1/8-inch open double end wrench, 6R55532-36.
1—1¼-1⅝-inch double open end wrench, 6R55540-42.
1—#6 Bristo wrench, 6R55230.
1—Medium screw driver, TL-456/U, 6R14990.
1—Small Phillips screw driver, 6R15999.
1—Medium Phillips screw driver, TL-457/U, 6R15600.
1—Insulated screw driver.

b. MATERIALS.

Orangestick, 6Z7360.
Cheesecloth, bleached, lint-free, 6Z1989.
Carbon tetrachloride, 6G184.1.
Paper, sand, flint #000, 6Z7500-000.
Paper, sand flint #0000 6Z7500-0000.
Solvent dry-cleaning (SD) (Fed spec No. P-S-66la) QM #51-S-4385-1.

23. Definition of Preventive Maintenance

Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order so that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from trouble shooting and repair since its object is to prevent certain troubles from occurring. See TM 38-650.

24. General Preventive Maintenance Techniques

a. Use No. 0000 sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning.

(1) If necessary, except for electrical contacts, moisten the cloth or brush with solvent, dry-cleaning (SD); then wipe the parts dry with a cloth
(2) Clean electrical contacts with a cloth moistened with carbon tetrachloride; then wipe them dry with a dry cloth.

c. If available, dry compressed air may be used at a line pressure not exceeding 60 P.S.I. to remove dust from inaccessible places; be careful, however, or mechanical damage from the air blast may result.

d. For further information on preventive maintenance techniques refer to TB SIG 178.

25. Performing Preventive Maintenance

The following preventive maintenance operations should be performed by organizational personnel at the intervals indicated, unless these intervals are reduced by the local commander:

CAUTION: Screws, bolts, and nuts should be tightened carefully. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

DAILY

1. Clean exterior of cabinet and panel.
2. Check operation of panel light.
3. Check for correct meter operation (par. 16).
4. Check panel mounting screws, control knobs, and switches for loose mounting.
5. Check condition of r-f cables and power cord.

WEEKLY

Caution: Disconnect all power before performing the following operations. Upon completion, reconnect power and check for satisfactory operation.

1. Clean interior of cabinet, exterior of all chassis, and all accessible parts.
2. Inspect filter capacitors C20 and C21 for leakage of oil or dielectric, for bulging, and for heating.
3. Inspect power transformer T2 for excessive heating.
4. Inspect fuse F1 and fuse holder for corrosion, cracks, and lack of tension sufficient to insure good contact.
5. Check meters for zero adjustments.

MONTHLY

Make visual inspection of the following; tighten and/or clean *if necessary*:

1. Tube sockets and pins, for loose contacts, dirt, and corrosion. Check vacuum tubes (fig. 15).
2. Filter capacitors C20 and C21 terminals, for corrosion.
3. Resistors for blistering, discoloration, and other evidence of overheating.
4. Switches S1, S2, and S3 for dirt, corrosion, loose contacts, and unsatisfactory mechanical action.
5. Wires, cords, and cables, for cracked, cut, and frayed insulation.
6. Terminal boards, for cracks, dirt, and loose connections.
7. Potentiometers for unsatisfactory electrical and mechanical operation.
8. Mounting, machine screws, and nuts, for mechanical looseness.
9. All visible terminals and connections for loose connections and corrosion.
10. Finish for scratches and bare spots.
11. Variable capacitor C15, for dirt, corrosion, and bent plates.
12. Coils L1 and L2, for dirt, corrosion, and damaged turns.
13. Insulators for cracks.
14. Selenium rectifiers, for loose connections and dirt.

Section II. WEATHERPROOFING AND LUBRICATION

26. Lubrication

No lubrication is required on Signal Generator Set AN/URM-27.

27. Weatherproofing

a. GENERAL. Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

b. TROPICAL MAINTENANCE. A special moisture-proofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is explained fully in TB SIG 13 and TB SIG 72.

c. WINTER MAINTENANCE. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained fully in TB SIG 66.

d. DESERT MAINTENANCE. Special precautions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust are explained fully in TB SIG 75.

28. Rustproofing and Painting

a. When the finish on the case has been badly scarred or damaged, rust and corrosion can be prevented by touching up bared surfaces. Use #000 sandpaper to clean the surface down to the bare metal; obtain a bright smooth finish.

CAUTION: Do not use steel wool. Minute particles frequently enter the case and cause harmful internal shorting or grounding of circuits.

b. When a touch-up job is necessary, apply paint with a small brush. Remove rust from the case by cleaning corroded metal with solvent (SD). In severe cases it may be necessary to use solvent (SD) to soften the rust and to use sandpaper to complete the preparation for painting. Paint used should be authorized and consistent with existing regulations.

Section III. TROUBLE SHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

29. Scope

a. The trouble shooting and repair work that can be performed at the organizational maintenance level (operators and repairmen) is necessarily limited in scope by the tools, test equipment, and replaceable parts issued, and by the existing tactical situation. Accordingly, trouble shooting is based on the performance of the equipment and the use of the senses in determining such troubles as burned-out tubes, cracked insulators, etc.

b. The paragraphs which follow in this section help in determining which of the circuits is at fault and in localizing the fault in the circuit to the defective stage or item, such as a tube or fuse.

30. Visual Inspection

a. Failure of this equipment to operate properly usually will be caused by one of the following faults:

(1) Plugs not secure.
(2) Worn, broken, or disconnected cords.
(3) Burned-out fuse.
(4) Wires broken because of excessive vibration.
(5) Defective tubes.
(6) Resistors burned by condenser or tube failure.
(7) Improperly soldered joints.

b. When failure is encountered and the cause is not immediately apparent, check as many of the above items as is practicable before starting a detailed examination of the component parts of the system. If possible, obtain information from the operator of the equipment regarding performance at the time trouble occurred.

31. Trouble Shooting by Using Equipment Performance Checklist

a. GENERAL. The equipment performance checklist (par. 32) will help the operator to locate trouble in the equipment. The list gives the item to be checked, the conditions under which the item is checked, the normal indications and tolerances of correct operation, and the corrective measures the operator can take. *To use this list, follow the items in numerical sequence.*

b. ACTION OR CONDITION. For some items, the information given in the action or condition column consists of various switch and control settings under which the item is to be checked. For other items it represents an action that must be taken to check the normal indication given in the normal indications column.

c. NORMAL INDICATIONS. The normal indications listed include the visible and audible signs that the operator should perceive when he checks the items. If the indications are not normal, the operator should apply the recommended corrective measures.

d. CORRECTIVE MEASURES. The corrective measures listed are those the operator can make without turning in the equipment for repairs. A reference in the table to chapter 5 indicates that the trouble cannot be corrected during operation and that trouble shooting by an experienced repairman is necessary. If the set is completely inoperative or if the corrective measures do not yield results, trouble shooting is necessary. However, if the tactical situation requires that service must be maintained and if the set is not completely inoperative, the operator must maintain the set in operation as long as it is possible to do so.

32. Equipment Performance Checklist

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	1	R-f cable assembly W1 or W2.	Attach to OUTPUT jack J3.		
	2	Power cable W3.	Plug into a-c power source.		
	3	DEVIATION control.	Full counter-clockwise position.		
	4	METER SET control.	Full counter-clockwise position.		
	5	Modulation switch.	400 cps position		
	6	HI-LO METER RANGE switch.	HI position.		
START	7	Power switch.	Turn to ON position.	Pilot lamp lights.	Check fuse F1. Check line cord. Check pilot lamp.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
EQUIPMENT	8	DEVIATION control.	Rotate clockwise.	KC DEVIATION meter reading increases with clockwise rotation of DEVIATION control.	Check meter; check crystal CR3A. Check tubes V1 and V2.
	9	METER SET control.	Rotate clockwise.	R-f meter reading increases with clockwise rotation of METER SET control.	Check tubes V3 and V7. Check crystal CR4. Check connections on terminal board E5 in r-f casting. Check jack J2.
PERFORMANCE	10	Modulation switch.	Set to 1,000 CPS, 400 CPS, EXT MOD and OFF in turn.	Deviation meter reads in 1000 CPS and 400 CPS positions. In EXT MOD position, deviation meter reads only when external audio source is connected to EXT MOD binding posts. In OFF position there is no reading on deviation meter.	Refer to chapter 5.
	11	ATTENUATION control.	Rotate clockwise.	R-f output power increases.	Refer to chapter 5.
	12	MEGACYCLES tuning control.	Rotate through range.	R-f output frequency changes with tuning dial calibration.	Refer to chapter 5.
STOP	13	Power switch	Throw to off position.	Pilot lamp goes out.	

CHAPTER 4

THEORY

33. Block Diagram (fig. 6)

Signal Generator Set AN/URM-27 is an f-m signal generator with a frequency range of 18 to 109 mc. The signal path is shown in figure 6. A complete schematic diagram is shown in figure 27.

a. Audio Oscillator (V1). The audio oscillator stage is a phase shift oscillator, which generates either a 400-cps or a 1,000-cps sinusoidal wave as determined by the modulation switch S1. The audio oscillator is inoperative when the modulation switch is in either the EXT MOD or OFF position.

b. Audio Amplifier (V2). Sine wave audio voltages from the audio oscillator or from an external source are selected by switch S1 and passed through the DEVIATION control to the grid of the audio amplifier, V2. This tube amplifies the audio oscillations and produces a sine wave signal which is coupled to the r-f oscillator stage by transformer, T1.

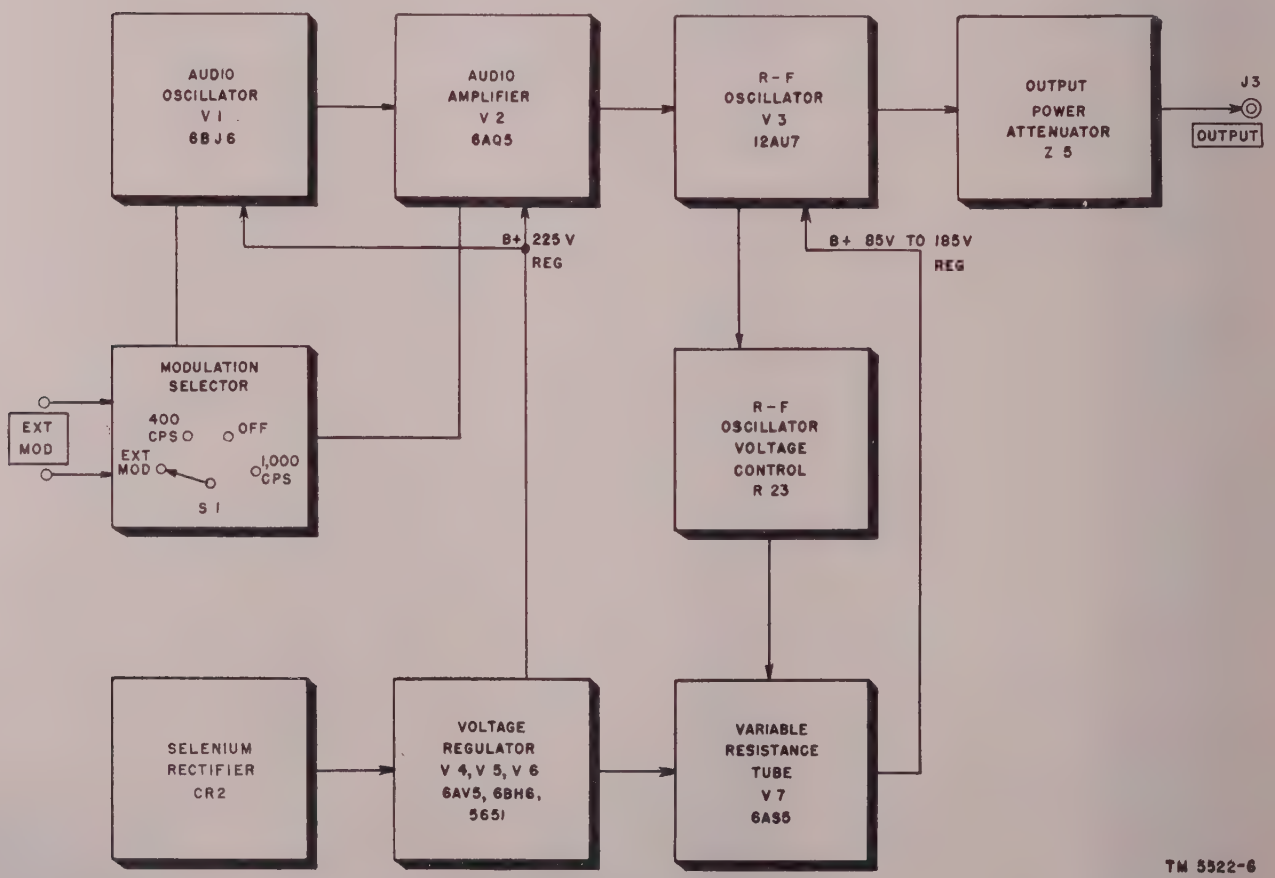


Figure 6. Signal Generator Set AN/URM-27, block diagram.

c. R-F Oscillator (V3). The r-f oscillator is a modified Colpitts shunt-fed type, in which both the inductance and capacitance of the tuned circuit are varied to obtain a wide frequency range. The output of the oscillator is coupled inductively to the output attenuator.

d. Output Attenuator (Z5). The attenuator is a mutual inductance type, logarithmic attenuator. The attenuated output appears at OUTPUT jack J3.

e. Modulation Switch (S1). This switch selects the frequency of the modulating signal. Provision is made for the application of an external modulation source.

f. Rectifier (CR2). The full-wave selenium rectifier takes an alternating voltage from the high voltage winding of the power transformer and delivers a d-c voltage to the input of a low-pass filter.

g. Voltage Regulator (V4, V5, V6). The voltage regulator circuit drops the filtered d-c voltage from the power supply to the desired B+ voltage and holds this voltage constant despite line voltage or load current changes. The voltage regulator tube V6 establishes a constant voltage; the d-c amplifier V5 amplifies any variations in the regulated B+ voltage. The output of V5 is fed to the grid of variable resistance tube V4. The effective impedance of V4 varies so as to oppose the changes in the B+ voltage.

h. R-F Oscillator Voltage Control (R23). This control is coupled mechanically to main tuning condenser C15 and supplies a control voltage to variable resistance tube V7.

i. Variable Resistance Tube (V7). This tube reduces the r-f oscillator plate voltage to a value which maintains the r-f output nearly constant.

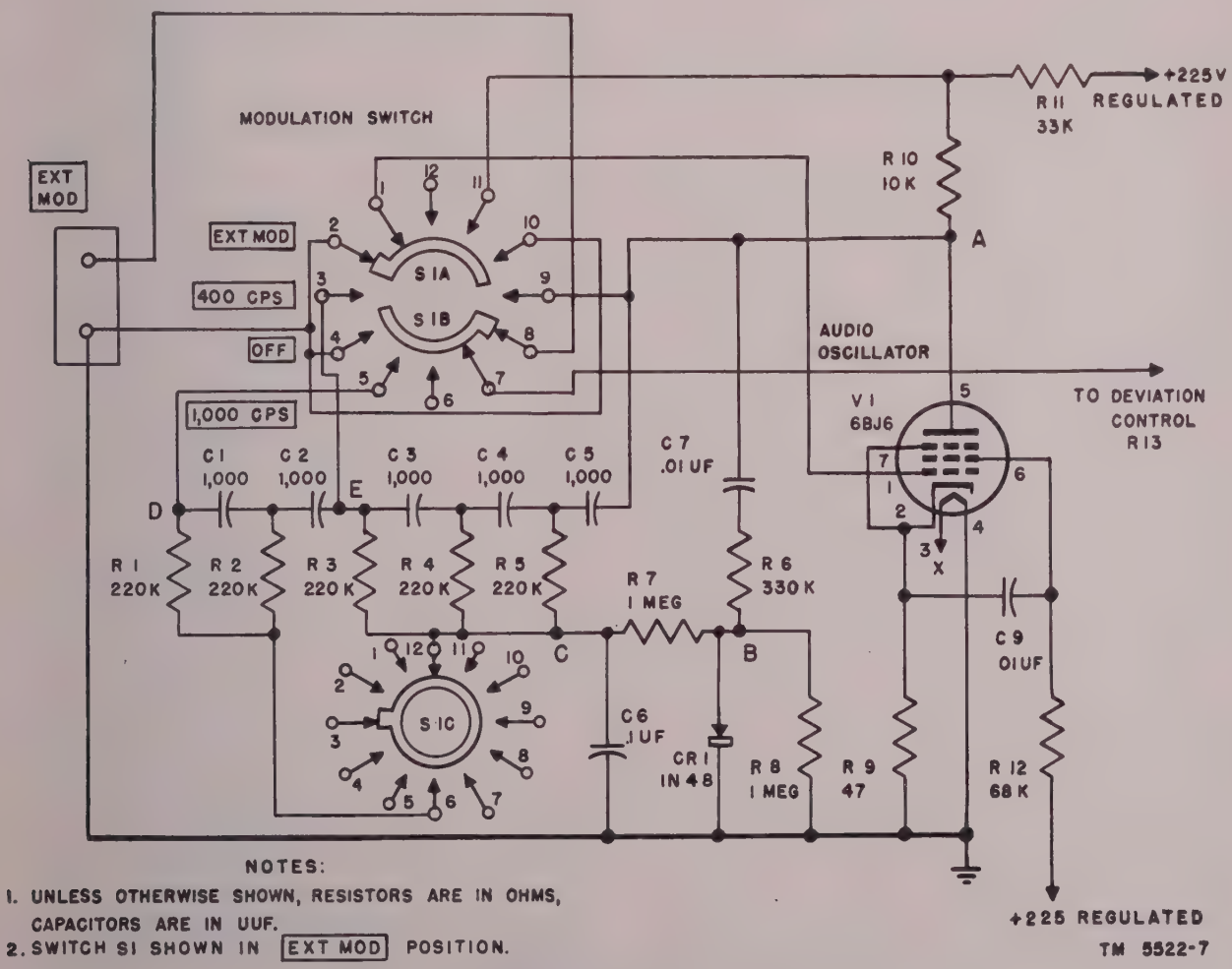


Figure 7. Modulation switch and audio oscillator, simplified schematic diagram.

34. Audio Oscillator (fig. 7)

For oscillations to occur in an amplifier, the feedback voltage must be in phase with the input voltage, and the overall amplification must be greater than unity.

a. The audio oscillator stage uses a phase shifting network consisting of series capacitors C1 through C5 and shunt resistors R1 through R5. This network feeds energy from the plate circuit of remote cut-off pentode tube V1 back to its grid circuit. The phase shift in the network is proportional to the frequency passed through it. Since the alternating plate voltage is 180° out of phase with the grid voltage, oscillations can occur only at that frequency which produces a further 180° phase shift in the R-C network. The required phase shift is produced in three sections (60° phase shift per section) for the 400 cps oscillation and in five sections (36° phase shift per section) for the 1,000 cps oscillation. The two additional sections are switched in by the modulation switch S1.

b. To insure that the overall amplification is greater than unity, a tube with sufficient gain must be used. However, the bias must be adjusted so that the circuit barely oscillates if a true sinusoidal output is desired. Since both gain and loss are somewhat uncertain, an automatic gain control circuit is incorporated in the grid circuit of V1 to maintain oscillation at the desired level and to preserve good waveform. The automatic gain control circuit consists of C6, C7, R6, R7 R8, and CR1. The germanium crystal CR1 produces a control voltage by rectifying the oscillator output voltage fed to it through C7 and the voltage divider consisting of resistors R6 and R8. The a-c component is removed by the R-C filter R7 and C6, which has a time constant that is large com-

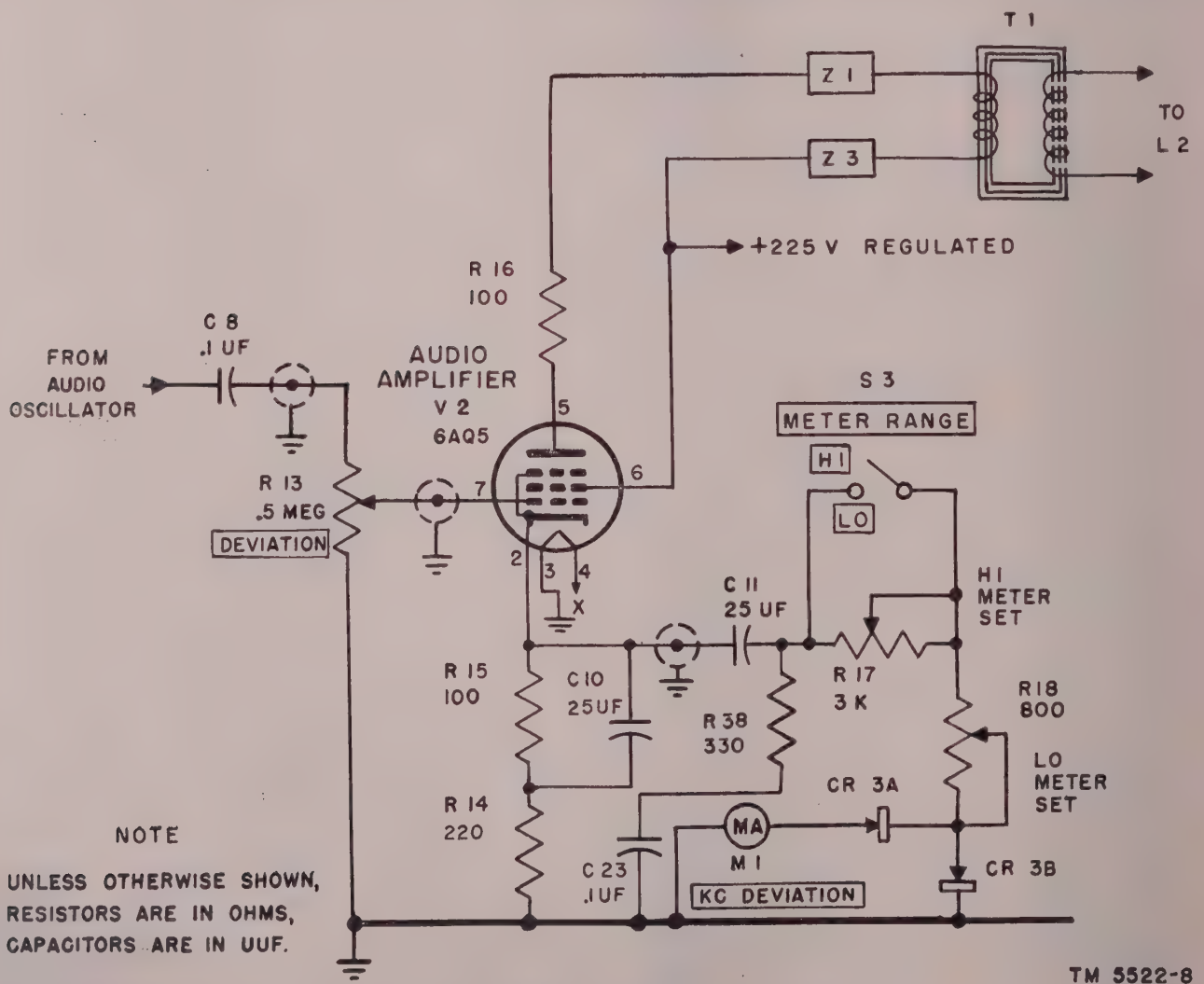


Figure 8. Audio amplifier, simplified schematic diagram.

pared to the audio frequencies used. The smoothed control voltage reaches the grid of the oscillator through the last shunt resistors of the phasing network, R3 or R1, depending on whether S1 is in the 400 cps or the 1,000 cps position.

c. When the output voltage increases, the potential drop across R10 increases and point A becomes more negative. Hence, the potentials at Points B and C also become more negative. This increased negative potential is transferred through resistor R3 or R5 and switch S1 to the grid of tube V1. However, when the grid becomes more negative, the transconductance of V1 is reduced; this effect opposes the original increase and tends to keep the output voltage constant. When the output voltage decreases, the action is similar. Some degenerative feedback is provided by the unbypassed cathode resistor R9 to improve the waveshape. Resistors R10 and R11 comprise a voltage divider which corrects for the difference in output produced at the two oscillating frequencies. Screen voltage is fed to V1 through dropping resistor R12 and is bypassed to the cathode by capacitor C9.

35. Audio Amplifier (fig. 8)

a. The modulating voltages, either internal or external, are fed to the grid of beam power tube V2 through coupling capacitor C8 and DEVIATION control R13. V2 operates as a Class A amplifier. A more detailed description is given in paragraph 36.

b. In a frequency-modulated system, the amplitude of the modulating signal determines the variation from the original carrier or *resting* frequency. The amount of this variation is known as *deviation.* The amplitude of the audio modulating voltage is determined by variable resistor R13; therefore, R13 controls the deviation.

c. An r-f wave which is frequency-modulated with a single audio frequency consists of the carrier plus a series of side bands above and below the carrier. If this audio frequency is kept constant and the deviation is varied, the energy of the resultant r-f wave shifts between the carrier component and the various side bands. At specific values of deviation, the energy in the carrier component of the r-f output is zero. This fact can be used to calibrate the deviation of the signal generator set (par. 60).

d. Plate voltage is delivered to V2 through the primary of T1 and parasitic suppressor R16. The screen grid is connected directly to the regulated B+ source. Self-bias is derived from the potential drop across resistors R14 and R15. Capacitor C10 bypasses R14 to prevent excessive degeneration but R15 is left unbypassed to deliver an audio voltage to KC DEVIATION meter M1. When the a-c potential across R15 is negative with respect to ground, electrons flow through CR3B but not through CR3A. Hence, capacitors C10 and C11 acquire a charge which produces a voltage drop equal to the peak value of the sine wave voltage appearing across R15. On the positive half cycle, CR3A conducts and CR3B does not; the potential drop across R15 is added to the drop across C10 and C11 so that approximately twice the a-c voltage is applied to M1. Thus, CR3A and CR3B act as a half-wave voltage doubler.

e. Variable resistors R17 and R18 provide means for calibrating the KC DEVIATION meter to read correctly on its HI and LO ranges. In the LO position, R17 is shorted; in the HI position, R17 and R18 are in series. This decreases the potential drop across meter M1, permitting it to read higher voltages. Although the adjustment of R18 is independent of R17, the opposite is not true. The sequence of adjustments always should be first to adjust R18 with the METER RANGE switch S3 in the LO position; then set R17 with S3 in the HI position (par. 60).

f. Resistor R16 is a parasitic suppressor. It tends to eliminate instability during plate current peaks. Capacitor C11 blocks the d-c component of cathode current from the meter circuit.

36. R-f Oscillator (fig. 9)

The r-f oscillator V3 is a modified shunt-fed Colpitts oscillator, which generates the *resting* or original carrier frequency. The resting frequency is determined primarily by split capacitors C15A and C15B and coils L1 and L2. The feedback is determined by the capacitance ratio of C15B to C15A; this ratio is approximately 2 to 1 over the tuning range.

a. The method of obtaining the d-c plate voltage is described in paragraph 41. L3 and L4 are r-f chokes in the plate and filament circuits respectively. Resistors R20, R21, and R22 and capacitors C16 and C17 comprise a low pass r-f filter. Networks Z1, Z2, Z3, Z4, Z6, and Z7 provide r-f decoupling and minimize undesired inductive and capacitive effects between the r-f cavity casting and the feedthrough loads

b The amplitude of oscillation is limited to stabilize the frequency and to reduce distortion. This is accomplished by grid-blocking capacitor C12 and grid leak resistor R19. When the grid draws no current, the voltage drop across R19 (and, therefore, the bias) is zero. When the grid is positive, however, it collects electrons. During the remainder of the cycle, the electrons leak off C12 and the grid through R19. This action places the grid at a negative potential with respect to the cathode, thus providing bias. As the amplitude of the oscillation increases, the grid swings more positive and draws more current. There-

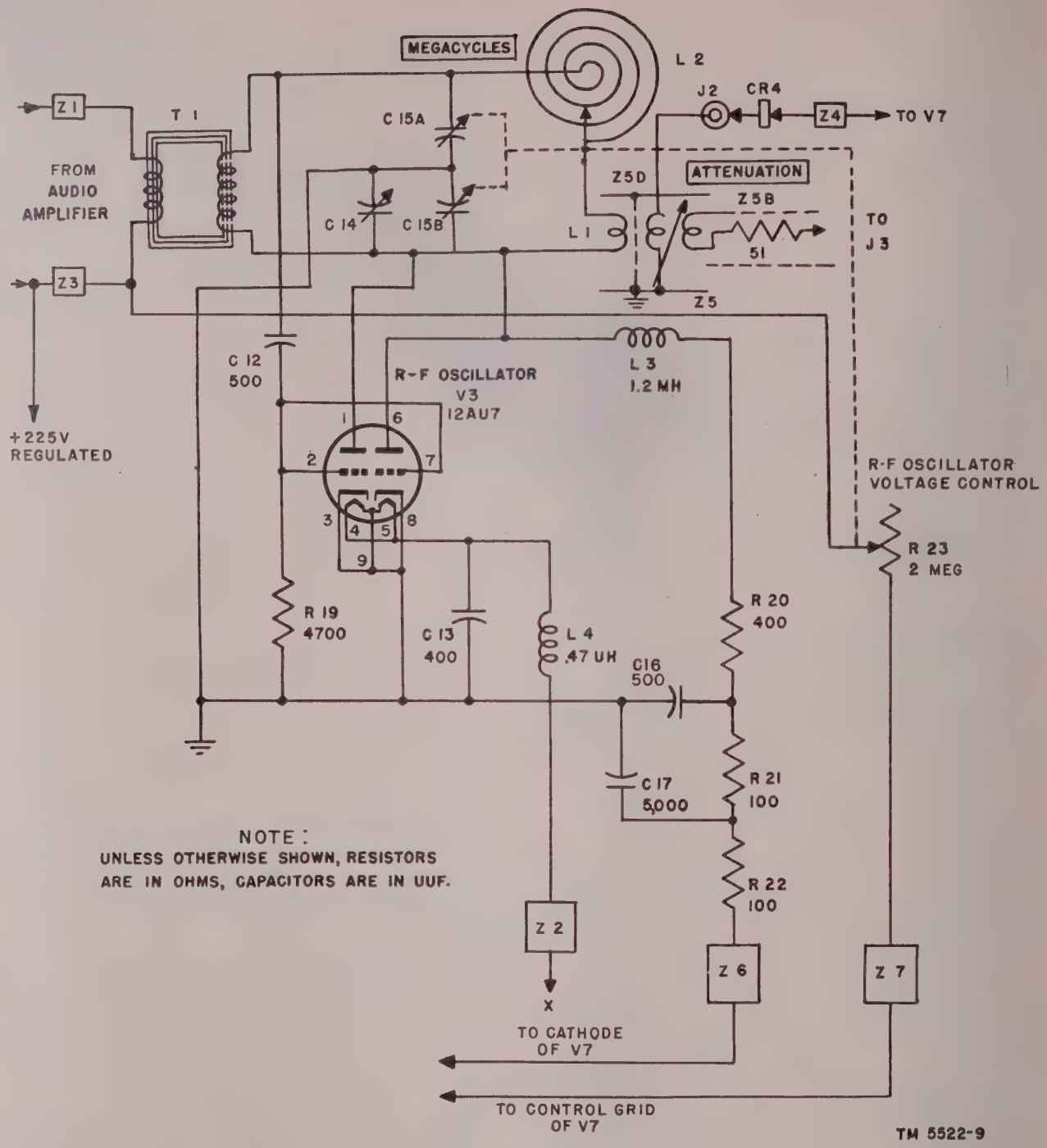


Figure 9. R-f oscillator, simplified schematic diagram.

fore, the bias increases negatively; and the transconductance of the tube is reduced until an equilibrium point is reached. Thus, the amplitude of the oscillation is limited.

c. Frequency modulation is produced by modulation inductance T1. Its secondary is connected across the r-f tank circuit. The secondary is wound on a saturable core of special variable permeability material that varies the effective inductance of the secondary winding in accordance with the density of flux in the core. The flux density, in turn, is determined by the current flowing in the primary of T1.

d. In a standard Colpitts oscillator, where either the capacitance or the inductance of the tank circuit is varied to produce the frequency change, the L-C (inductance-capacitance) ratio also will vary corre-

spondingly. That means that an identical change in the inductance of T1 will produce a variable shift in the r-f frequency, depending on the actual setting of the tuning control. If it is desired to obtain a frequency shift independent of the setting of the tuning control, careful proportioning of the frequency determining elements is required, particularly insofar as the selection of the L-C ratio of L1, L2, and C15 is concerned. If the inductance of T1 is large compared to that of L1 plus L2 and if the L-C ratio can be maintained constant, the frequency shift produced by a constant inductance change of T1 will be essentially constant over the entire band. The L-C ratio is maintained constant by varying L2 and C15 simultaneously.

c. Coil L1 performs two functions. It determines the minimum inductance of the oscillator tank, and hence, the frequency at the high end of the tuning range. In addition, it couples r-f energy into attenuator Z5. C14 is a trimmer capacitor which may be used to correct for tube capacitance changes in the event that replacement of V3 causes a change in the calibration of the MEGACYCLES dial.

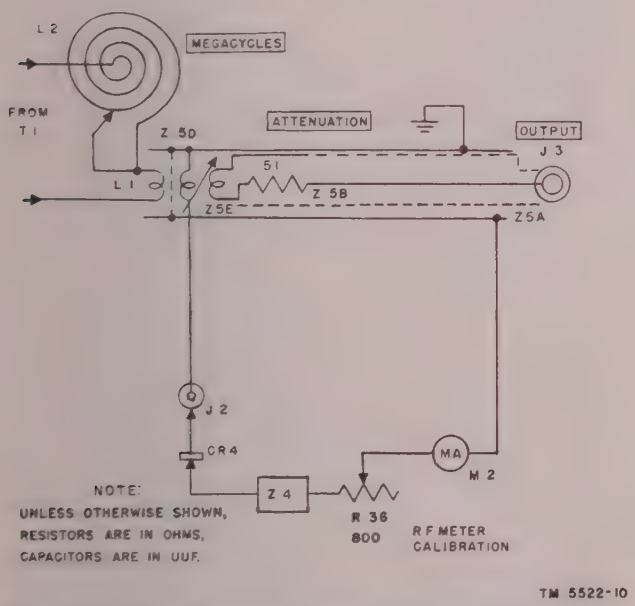


Figure 10. Output attenuator, simplified schematic diagram

37. Output Attenuator (Z5)

a. The output attenuator (fig. 10) is a mutual inductance attenuator, in which the output voltage is controlled by varying the mutual inductance between two coils located in a tube. The oscillator tank current flows in L1, which creates an electromagnetic field in the end of the attenuator tube. The electric field is removed by a shorting wire, suitably oriented, which reduces errors resulting from capacitive coupling. The shorting wire is shown on the schematic as a dotted line to the right of L1. The magnetic field, which has a definite wave length, propagates down the tube and induces a voltage in the movable coil, Z5E. This coil is connected to r-f OUTPUT jack J3 through a length of flexible coaxial cable, Z5A. To eliminate standing waves and to obtain the maximum power transfer, the line is terminated in its characteristic impedance by resistor Z5B at the input end while the output cable provides the proper termination at the output end.

b. The attenuator tube acts like a waveguide operating at a frequency far below cut-off, waveguides being essentially high-pass devices. There is, therefore, a high rate of attenuation of the magnetic field as it propagates down the tube. This type of attenuation is caused mainly by internal reflections at the input end. The attenuation rate, which is logarithmic, can be calculated very accurately; it is 31.9 db per diameter for this tube. The calibration on the dial will be seen to be logarithmic on the μv scale and linear on the db scale. The attenuator input is monitored by the circuit consisting of Z5D, Z5C, Z4, R36, and M2. Z5D is a pick-up loop located just behind coil L1. A silicon crystal CR4 rectifies the r-f voltage appearing across the pick-up loop and delivers dc to meter M2. R-f bypassing and filtering takes place in Z4. R36 is a meter calibrating resistor.

38. Modulation Switch S1 (fig. 7)

This switch (fig. 7) is a four-position three-circuit switch. The first circuit (S1A) selects the input (terminal 1) to the grid circuit of the audio oscillator (V1). The second circuit (S1B) determines the input (terminal 7) to the audio amplifier (V2). The third circuit (S1C) adds two R-C sections to the phase shift network for the 1000 CPS position of the switch.

a. In the OFF position S1A connects the V1 grid to ground. S1B connects R13, the DEVIATION control, to ground thus preventing any voltage from reaching the grid of V2.

b. In the EXT MOD position, S1A connects the control grid of V1 to ground; S1B connects R13 across the EXT MOD terminals through coupling capacitor C8.

c. In the 400 CPS position, S1A connects the control grid of V1 to the third section (point E) of the phasing network; S1B connects R13 to the plate of V1 through C8; S1C opens the low end of the phasing network to avoid the shunting effect of the last two stages.

d. In the 1000 CPS position, S1A connects the control grid of V1 to the end (point D) of the phasing network, S1B connects R13 to the tap on dividers R10 and R11 through C8, and S1C closes the low end of the phasing network.

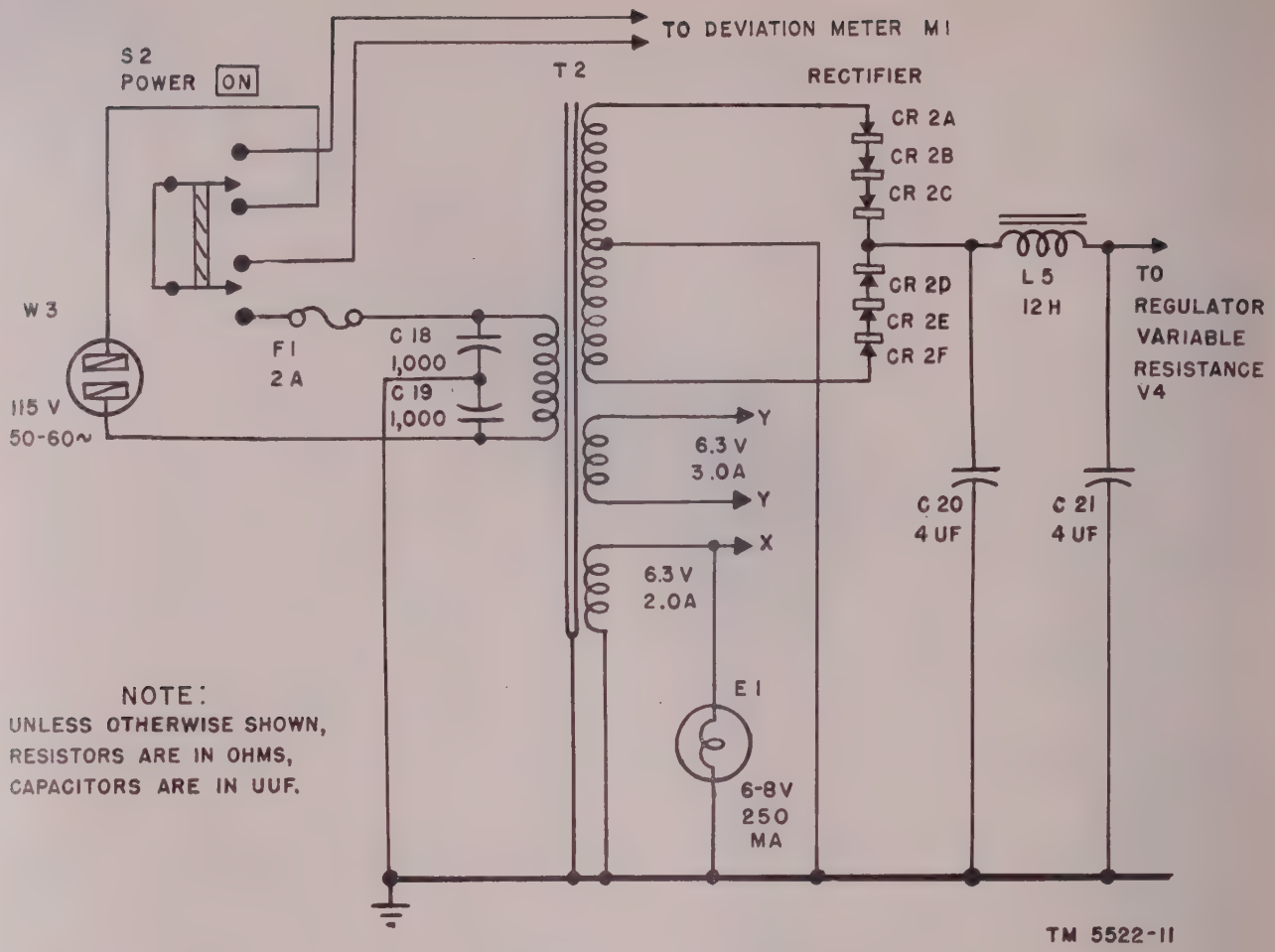


Figure 11. Rectifier and filter, simplified schematic diagram.

39. Selenium Rectifier (CR2)

a. The power supply consists of a power transformer (T2) whose primary winding receives power from the line through power switch S2 and protective fuse F1. A pair of r-f filter condensers (C18 and C19) are connected from primary to chassis. The transformer has three secondary windings: 720 volts root-mean-square, center-tapped, rated at 70 milliamperes dc; 6.3 volts at 3 amperes; 6.3 volts at 2 amperes. The 720-volt winding supplies 360 volts to each side of a full-wave selenium rectifier. The 6.3-volt 3-ampere winding supplies heater power to V4 and V7. The 6.3-volt 2 ampere winding supplies power to all other heaters. The selenium rectifier has nine selenium elements on either side and supplies approximately 400 volts dc to the input of the filter.

b. The power filter is a capacitor input pi-section network consisting of a choke (L5) and two oil-filled capacitors (C20 and C21).

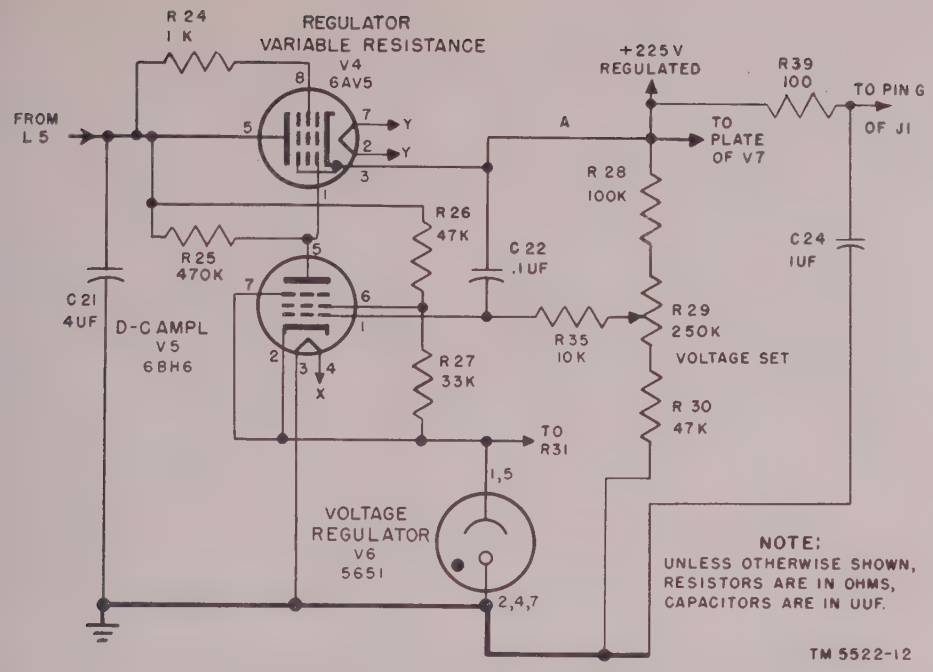


Figure 12. Voltage regulator stage, simplified schematic diagram.

40. Voltage Regulator Circuit (fig. 12)

The function of the voltage regulator circuit is to supply a B+ voltage that is constant despite load or a-c line fluctuations. The circuit consists of three stages, viz., a variable resistance tube V4, a d-c amplifier V5, and a voltage regulator tube V6. V6 clamps the cathode of V5 at a constant positive potential. V5 supplies a controlling voltage to the control grid of V4. V4 is in series with the B+ line. Therefore, the magnitude of the regulated B+ voltage will depend on the effective impedance of V4. This impedance varies so as to oppose changes in the regulated B+ output.

a. The plate voltage of V4 is determined by the series combination of V4, R28, R29, and R30, which is connected between the unregulated B+ and ground. The control grid voltage is determined by the series combination of R25, V5, and V6. Resistor R24 drops the screen grid voltage to the required value.

b. The plate voltage of V5 is the same as the control grid voltage of V4. The control grid voltage of V5 is established by the voltage divider consisting of R28, R29, and R30; this voltage can be changed by varying R29. The screen grid voltage is determined by the series combination of R26, R27, and V6, which is between the unregulated B+ and ground. The cathode of V5 is clamped at a positive potential by voltage regulator tube V6.

c. If the regulated output voltage (point A) increases because of load or line fluctuations, the potential at the variable arm of R29 will become more positive. Hence, the grid bias of V5 becomes more positive and the plate current increases. This action increases the potential drop across R25 thereby making the grid bias of V4 more negative. Because the bias is larger, the plate current of V4 decreases and the effective impedance increases. Therefore, the potential at point A decreases and the output remains nearly constant. If the potential at point A tends to increase, the voltage regulator action is similar.

d. Line voltage fluctuations are further minimized by connecting the screen grid voltage divider on the unregulated side of V4 (pin 5). If the unregulated B+ voltage increases, the screen grid voltage of V5 will increase also. This action increases the transconductance of V5 and, as discussed above, increases the effective impedance of V4. The result is that the original increase is limited. If the unregulated B+ voltage decreases, the action is similar.

e. Capacitor C22 insures that nearly all remaining a-c ripple in the output will be applied to the grid of V5, thus smoothing the output still more effectively. Grid resistor R35 keeps a high impedance between the grid and cathode when R29 is in its extreme position.

41. Variable Resistance Stage (fig. 13)

This stage establishes the plate potential of r-f oscillator tube V3. If this potential were constant, the oscillator output would have a different value for each carrier frequency used. The variable resistance stage stabilizes the r-f output so that only a minor manual correction is necessary.

a. The plate potentials of V3 and V7 are determined by the series combination of V7, Z6, R22, R21, R20, L3, and V3, which is connected between the regulated B+ and ground (fig. 13). The only way to vary the effective impedance of this combination (and, hence, to vary the plate potential of V3) is to vary the transconductance of V7. This can be accomplished by changing the control grid potential.

b. The control grid potential is determined by the voltage divider consisting of Z3, R23, Z7, R34, and R33. Since R23 is mechanically coupled to the main tuning shaft, as the shaft rotates, R23 varies to give a hyperbolic voltage variation at the control grid. This counteracts the inverse hyperbolic variation that the r-f output would have with a constant plate voltage. Therefore, the output remains approximately constant.

c. Manual adjusted for fine setting of output level is provided by potentiometer R33.

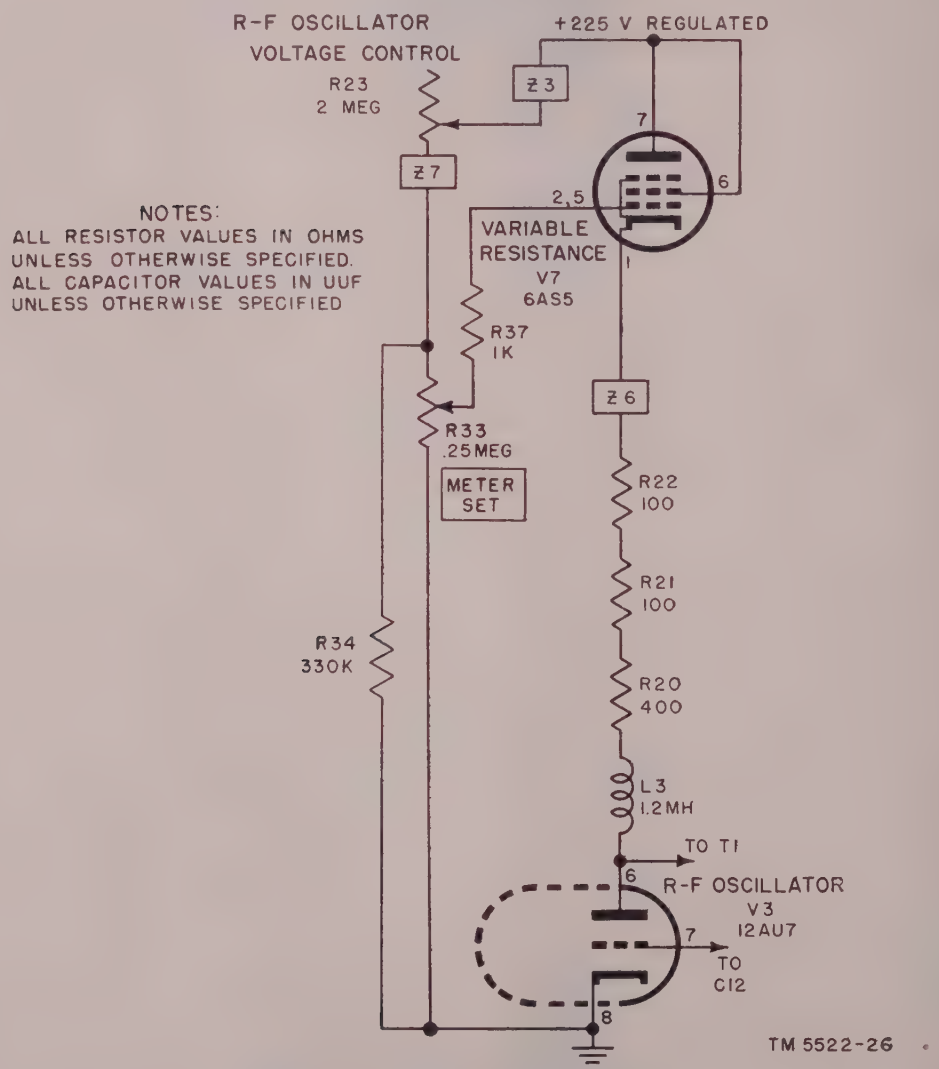


Figure 13. R-f voltage control diagram.

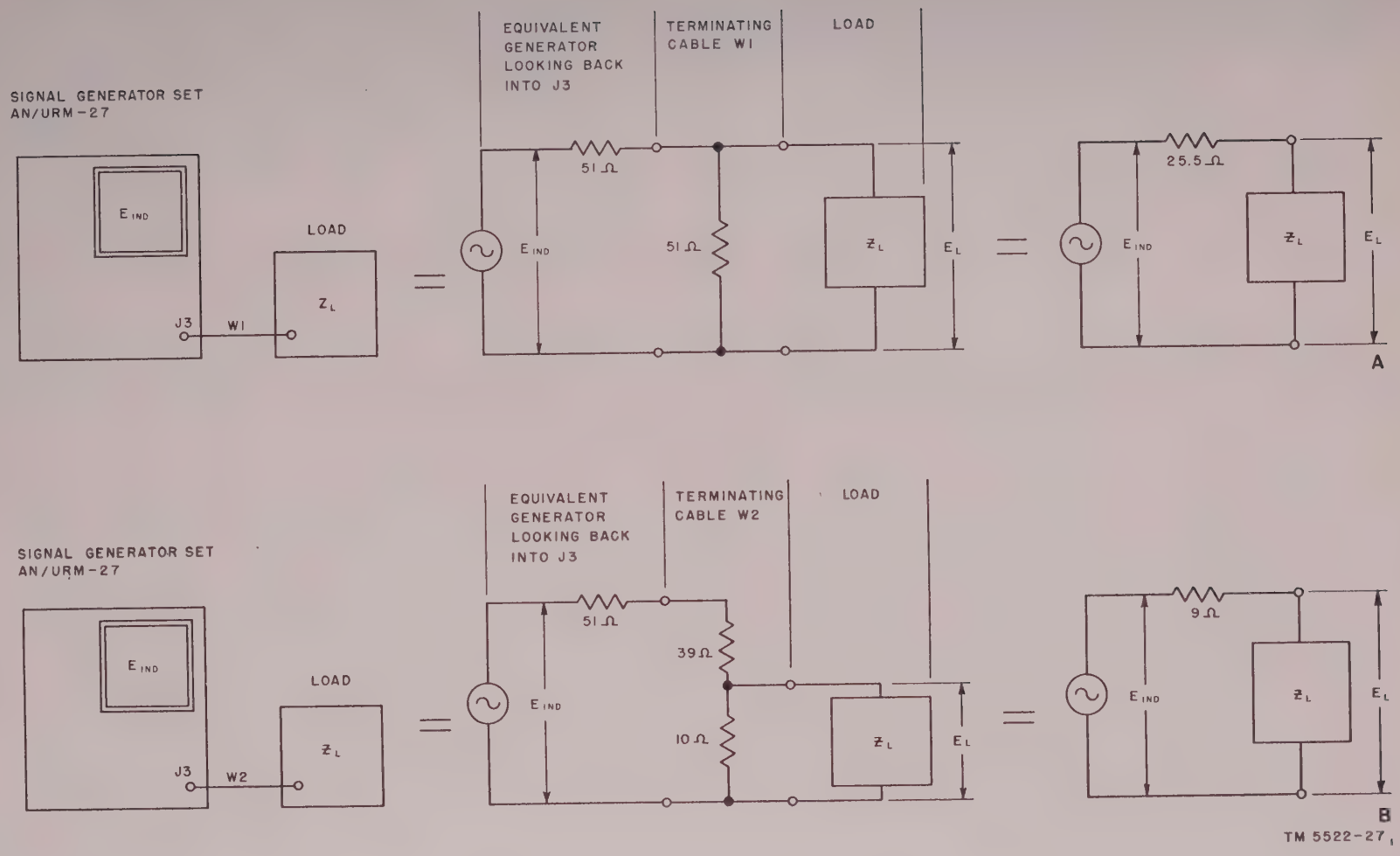


Figure 14. R-f output cables, equivalent diagrams.

42. R-f Output Cables (fig. 14)

R-f cable assemblies W1 and W2 transfer the output of Signal Generator Set AN/URM-27 to the equipment under test. Two cables are used so that two output voltage ranges are available. These cables must match the characteristic impedance of the flexible coaxial cable that connects Z5E to J3 (par. 37). If the r-f cables are not terminated properly, unpredictable resonance effects will cause erratic operation of the signal generator. Because of the cable terminations, the voltage E_L applied to the load (Z_L) is not necessarily the same as the voltage (E_{IND}) indicated on the ATTENUATION dial. The schematic diagrams of the r-f cables are shown on figure 27; the equivalent diagrams of the signal generator set, r-f cables, and load are shown in figure 14.

a. R-F Cable Assembly W1. This cable is used when a voltage range of .1 volt to .1μv is desired. It is represented in figure 14A by a 51-ohm resistor in parallel with load Z_L. The signal generator set can be considered as a constant voltage generator in series with a 51-ohm resistor. The ATTENUATION dial indicates the voltage (E_{IND}) of the equivalent constant voltage generator. Since the two 51-ohm resistors are in parallel, they equal a 25.5-ohm resistor in series with the constant voltage generator. Therefore, according to Ohm's law,

$$E_L = \frac{Z_L}{Z_L + 25.5} \times E_{IND}$$

When Z_L is greater than 250 ohms, the difference between E_{IND} and E_L is negligible for all practical purposes (par. 15g).

b. R-F Cable Assembly W2. This cable is used when a voltage range of .02 volt to .02 μv is desired. It is represented in figure 14B by the two series resistors of 39 ohms and 10 ohms. The load is connected across the 10-ohm resistor. Using the same reasoning as in the preceding sub-paragraph, the actual voltage applied to the load is given by:—

$$E_L = \frac{Z_L}{Z_L + 9} \times E_{IND}$$

When Z_L is greater than 100 ohms, the difference between E_{IND} and E_L is negligible (paragraph 15g).

CHAPTER 5

FIELD MAINTENANCE INSTRUCTIONS

Section I. TROUBLE SHOOTING AT FIELD MAINTENANCE LEVEL

Note. This chapter contains information for field maintenance. The amount of repair that can be performed by units having field maintenance responsibility is limited only by the tools and test equipment available and by the skill of the repairman.

WARNING: When servicing the signal generator set, be careful because high voltages are exposed. Discharge capacitors C20 and C21 before doing any testing.

43. Trouble-shooting Procedures

a. GENERAL. The first step in servicing a defective signal generator set is to sectionalize the fault. Sectionalization means tracing the faults to the *major stage or circuit* responsible for the abnormal operation of the set. The second step is to localize the fault. Localization means tracing the fault to the defective *part* reponsible for the abnormal condition. Some faults, such as burned-out resistors, r-f arcing, and shorted transformers often can be located by sight, smell, and hearing. The majority of faults, however, must be localized by *checking voltage and resistance.*

b. SECTIONALIZATION AND LOCALIZATION. The test listed below aid in isolating the source of trouble. To be effective, the procedure should be followed in the order given. Remember that servicing procedure should cause no further damage to the set. First, trouble should be localized to a single stage or circuit; then the trouble may be isolated within that stage by appropriate voltage, resistance and continuity measurements. The service procedure is summarized as follows:

(1) *Visual inspection.* The purpose of visual inspection (par. 30) is to locate any visible trouble. Through this inspection alone, the repairman frequently may discover the trouble or determine the stage in which the trouble exists. This inspection is valuable in avoiding additional damage to the test set which might occur through improper servicing methods and in forestalling future failures.

(2) *Power supply test.* The power supply test (par. 47) prevents further damage to the test set from certain possible short circuits. Since this test gives an indication of the operation of the entire test set and filter circuits, its function is more than preventive.

(3) *Operational test.* The operational test (par. 48) is important because it frequently indicates the general location of trouble. In many instances the information gained will determine the exact nature of the fault. In order to utilize this information fully, all symptoms must be interpreted in relation to one another.

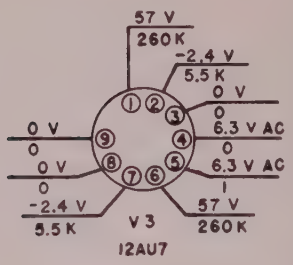
(4) *Trouble-shooting chart.* The trouble symptoms listed in this chart will aid greatly in localizing trouble.

(5) *Intermittents.* In all these tests, the possibility of intermittents should not be overlooked. If present, this trouble may often be made to appear by tapping or jarring the set. It is possible that the trouble is not in the signal generator set itself, but in the installation. In this event, test the installation if possible.

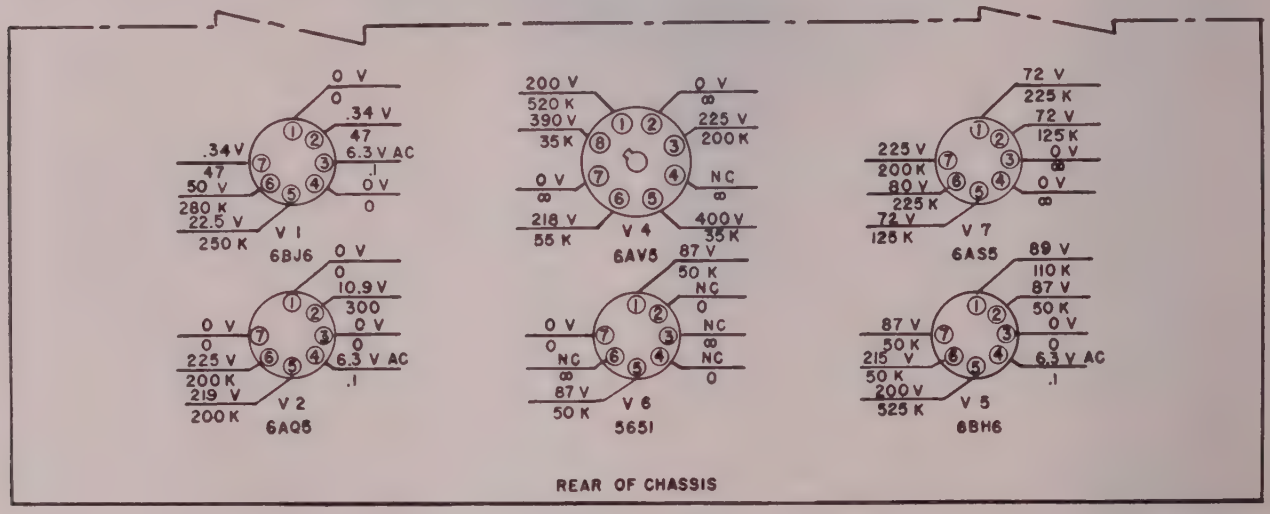
NOTES:

1. VOLTAGE MEASUREMENTS ARE MADE FROM TERMINAL TO GROUND AND ARE MADE WITH A 20,000 OHMS PER VOLT METER.
2. ALL VOLTAGES ARE POSITIVE DC TO GROUND UNLESS OTHERWISE SHOWN.
3. RESISTANCE MEASUREMENTS ARE MADE WITH ALL TUBES REMOVED FROM SOCKETS.
4. NC DENOTES NO CONNECTION.
5. ALL RESISTANCE VALUES ARE IN OHMS.

OSCILLATOR TUBE



SETTINGS OF CONTROLS: DEVIATION AND ATTENUATION KNOBS SET TO MAXIMUM CCW. POSITION. MEGACYCLES TUNING KNOB SET TO 60 MC.. ADJUST RF OUTPUT METER TO RED LINE. MODULATION SELECTOR SWITCH SET TO OFF POSITION.



TM 5522-14

Figure 15. Signal Generator Set AN/URM-27, voltage resistance measurements.

44. Trouble-shooting Data

Take advantage of the material supplied in this manual. It will help in the rapid location of faults. Consult the following trouble-shooting data:

Fig. No.	Description
Fig. 6	Signal Generator Set AN/URM-27, block diagram.
Fig. 7	Modulation switch and audio oscillator, simplified schematic diagram.
Fig. 8	Audio amplifier, simplified schematic diagram.
Fig. 9	R-f oscillator, simplified schematic diagram.
Fig. 10	Output attenuator, simplified schematic diagram.
Fig. 11	Rectifier and filter, simplified schematic diagram.
Fig. 12	Voltage regulator stage, simplified schematic diagram.
Fig. 13	Variable resistance stage, simplified schematic diagram.
Fig. 15	Signal Generator Set AN/URM-27, voltage and resistance measurements.
Fig. 16	Signal Generator Set AN/URM-27, top view of chassis.
Fig. 17	Signal Generator Set AN/URM-27, bottom view of chassis.
Fig. 18	Terminal boards, outline drawings.
Fig. 19	Signal Generator Set AN/URM-27, front view of oscillator assembly.
Fig. 20	Signal Generator Set AN/URM-27, rear view of oscillator assembly.
Fig. 21	Signal Generator Set AN/URM-27, exploded view of dial assembly.
Fig. 22	R-f oscillator frequency calibration, connection diagram.
Fig. 23	KC DEVIATION calibration, connection diagram.
Fig. 24	ATTENUATION output power calibration, connection diagram.
Fig. 25	Resistor color code.
Fig. 26	Capacitor color code.
Fig. 27	Signal Generator Set AN/URM-27, schematic diagram.

45. Test Equipment Required for Trouble Shooting

The test equipment required for trouble shooting Signal Generator Set AN/URM-27 is listed below:

Test equipment	Stock number	Technical manual
Tube Tester I-177	3F5700-177	TM 11-2627
Test Unit I-176	3F4470-176	TM 11-2626
Multimeter TS-352/U	3F4325-352	AN 16-35TS352-3
Oscilloscope OS-8A/U		NavShip 91272
Tube Socket Adapter Kit MX-949/U	2Z5731-949	TB 11-2627-3

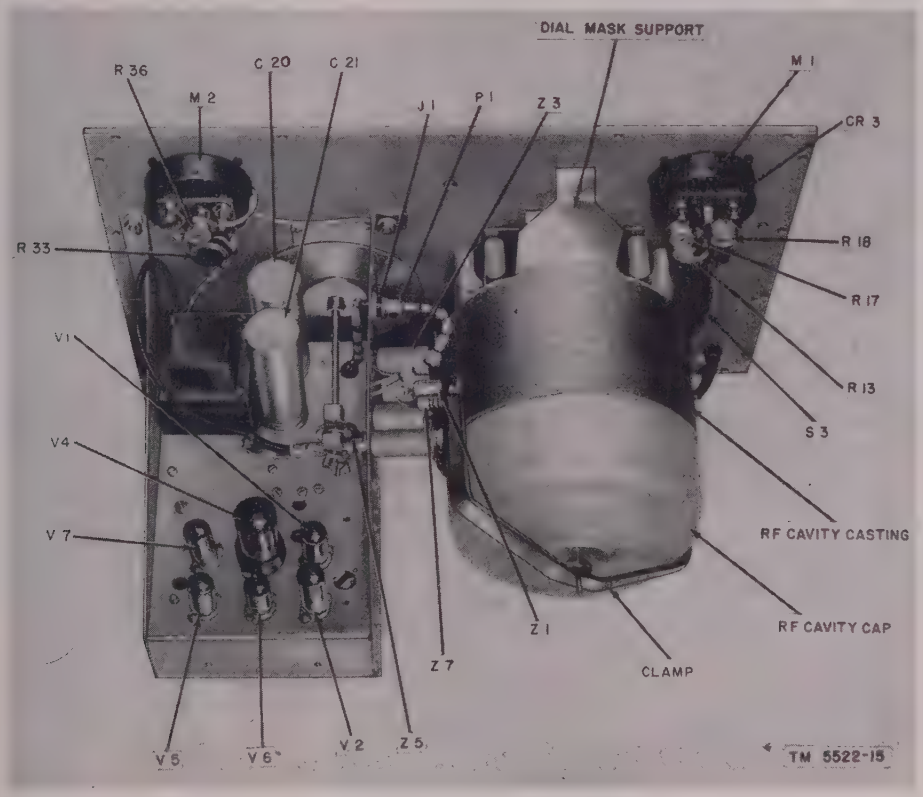


Figure 16. Signal Generator Set AN/URM-27, top view of chassis.

46. General Precautions

Whenever the signal generator is serviced, observe the following precautions very carefully:

a. Be careful when the cover is removed; dangerous potentials are exposed.

b. Careless replacement of parts often makes new faults inevitable. Note the following points:

(1) Before a part is unsoldered, note the position of the leads. If the part, such as a transformer, has a number of connections, tag each of the leads to it.

(2) Be careful not to damage other connections by pulling or pushing leads out of the way.

(3) Do not allow drops of solder to fall into the set since they may cause short circuits.

(4) A carelessly soldered connection may create a new fault. It is important to make well-soldered joints because a poorly soldered joint is one of the most difficult faults to find.

(5) When a part is replaced in r-f circuits, it must be placed exactly as the original one was. A part which has the same electrical value but different physical size may cause trouble in high-frequency circuits. Give particular attention to proper grounding

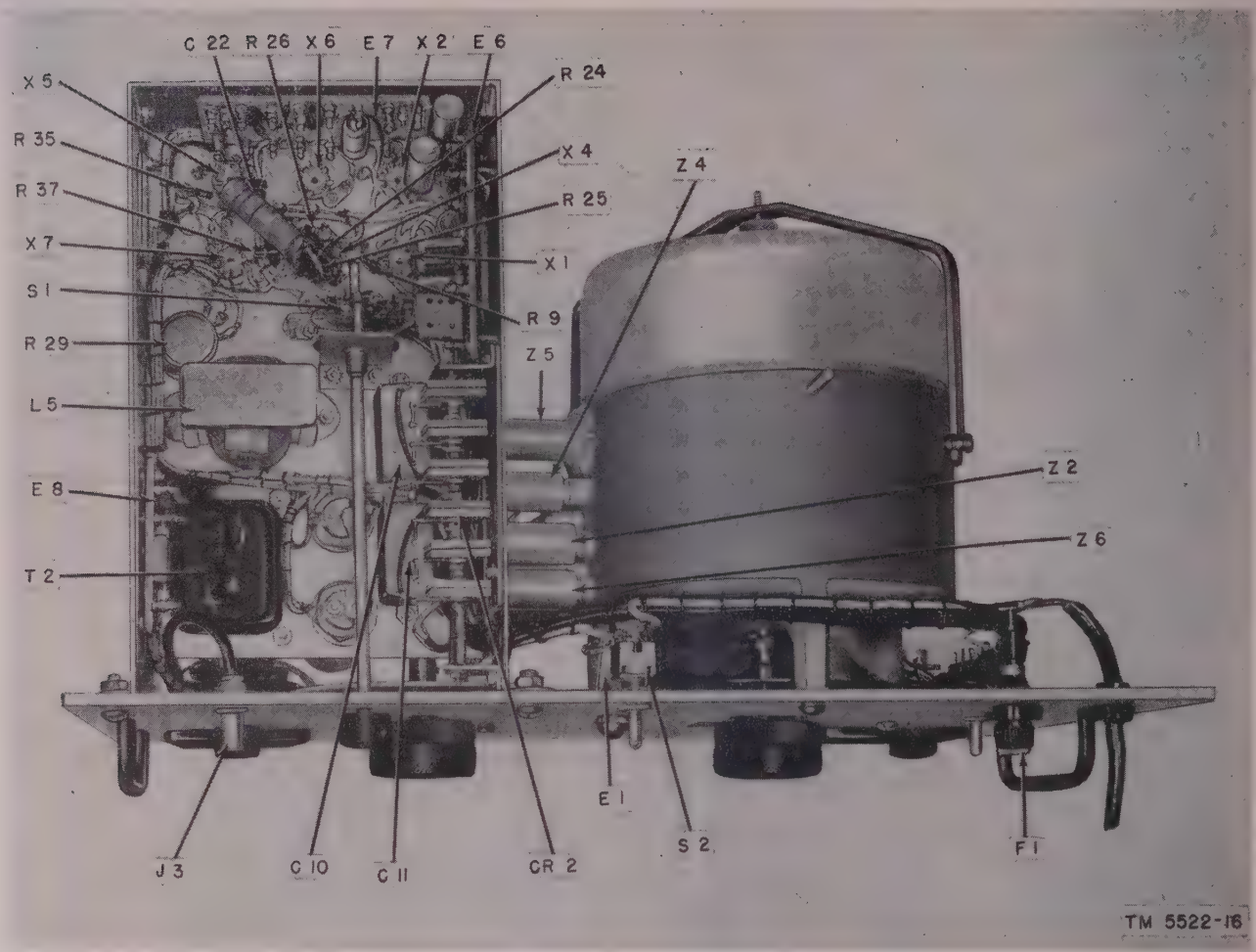


Figure 17. Signal Generator Set AN/URM-27, bottom view of chassis.

when replacing a part. Use the same ground as in the original wiring. Failure to observe these precautions may result in decreased gain or possibly in oscillation of the circuit.

(6) Do not disturb the VOLTAGE SET control R29.

(7) Use the appropriate range on any meters or test sets used for trouble shooting.

47. Power Supply Test

Trouble within the signal generator set may often be detected by checking the resistance of the filament and h-v (high-voltage) circuits before applying power to the equipment, thereby preventing damage to the power supply. Make the following checks before trying to put the signal generator set in operation:

a. The resistance across the input terminals of power cord W3 should be infinite with power switch S2 in the off position; in the ON position, the resistance should be approximately 6 ohms. If the reading is zero, the primary of power transformer T2 is shorted. Correct the trouble before applying power

FIG. A
E6

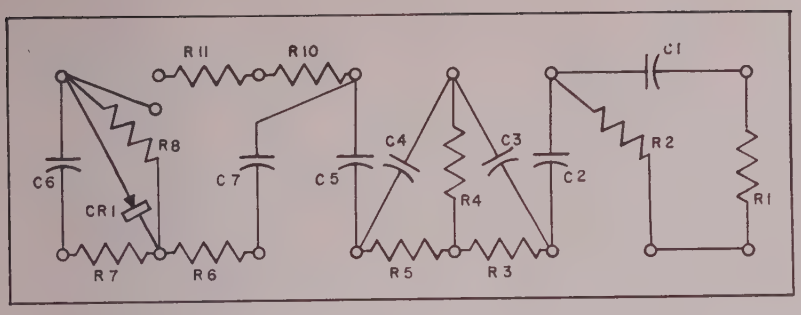


FIG. B
E8

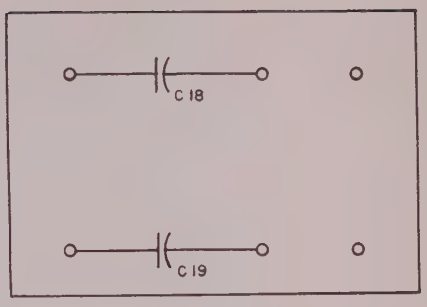
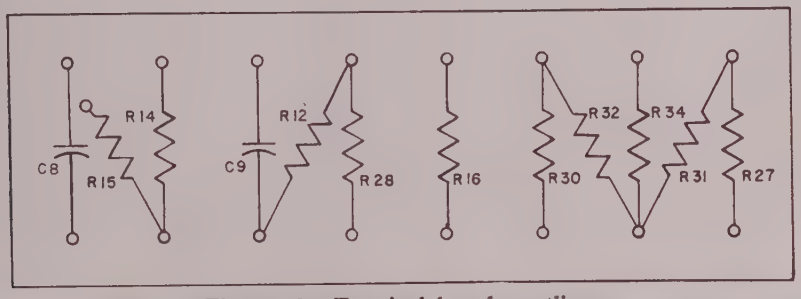


FIG. C
E7



TM 5522-13

Figure 18. Terminal boards, outline.

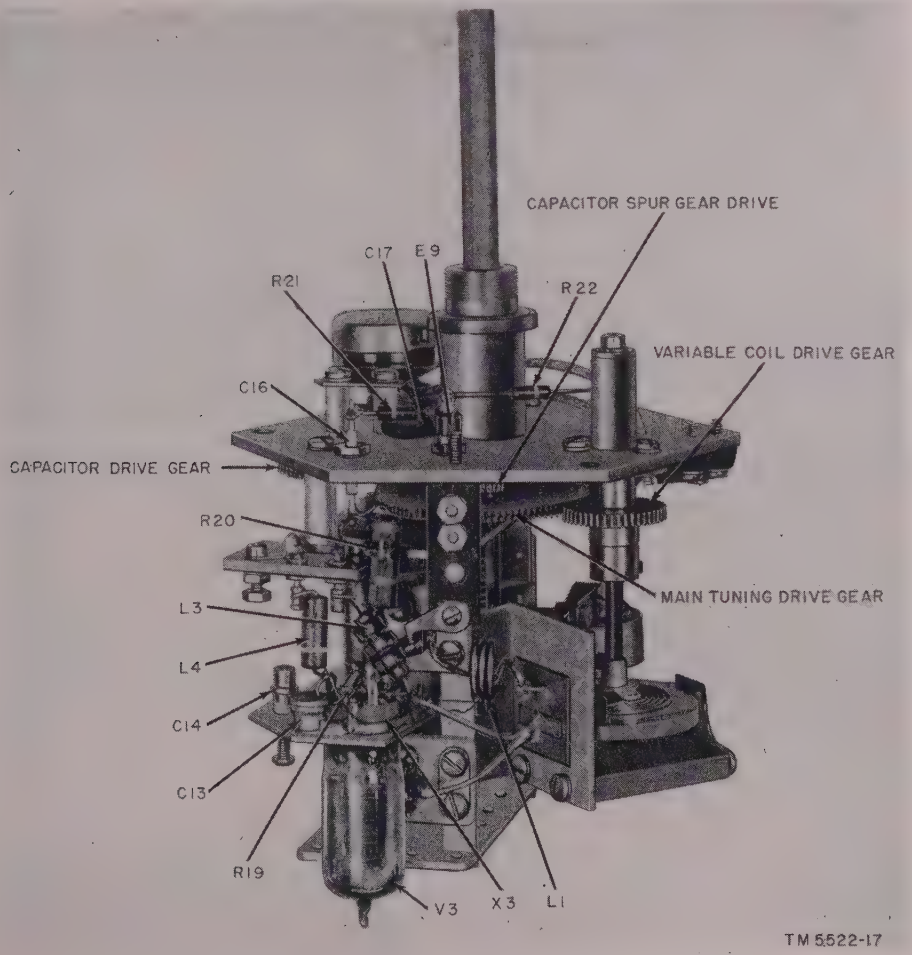


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Figure 19. Signal Generator Set AN/URM-27, front view of oscillator assembly.

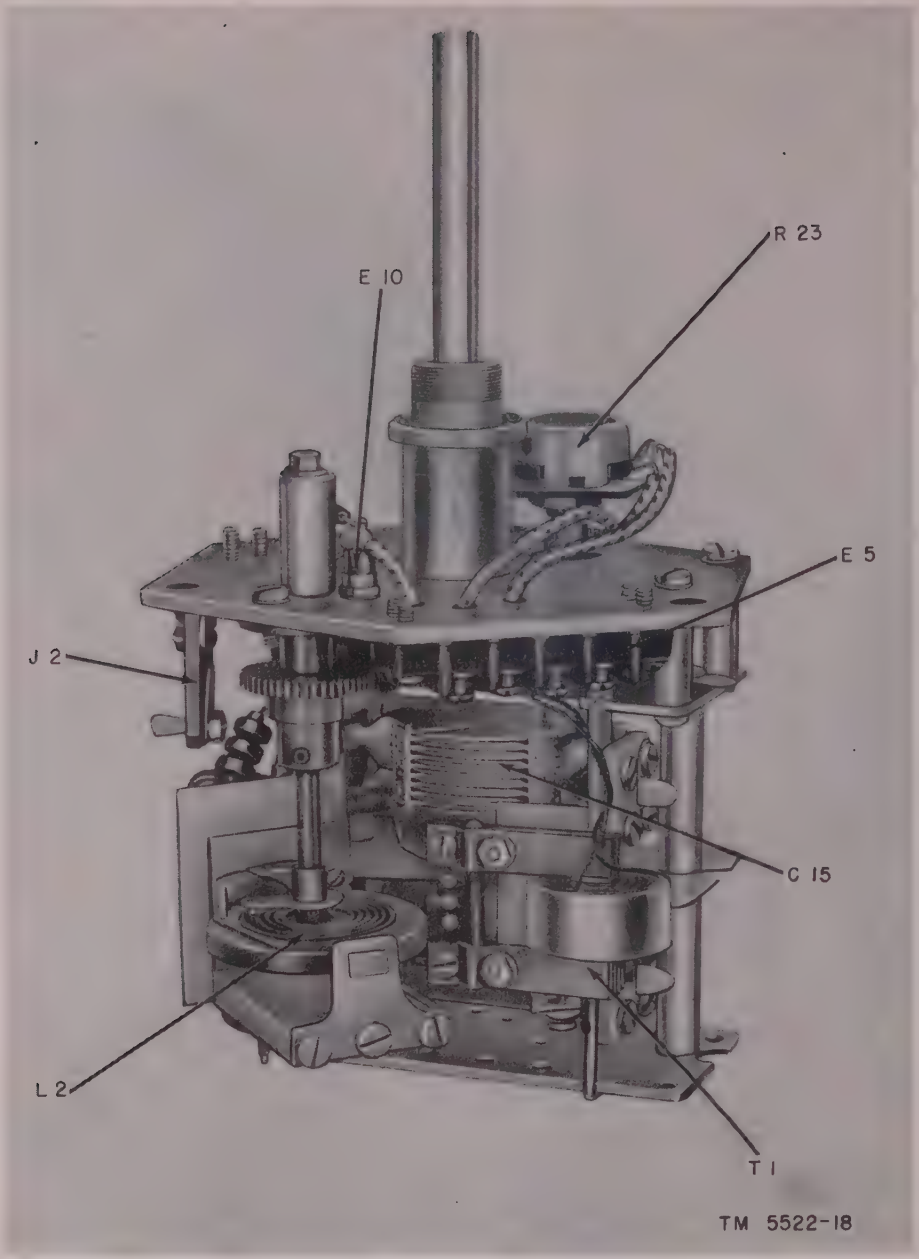


Figure 20. Signal Generator Set AN/URM-27, rear view of oscillator assembly.

to the set.

b. Measure the resistances at the sockets of tubes V4, V5, V6, and V7. Any deviation from the readings given on the voltage and resistance chart (fig. 15) indicates trouble and should be corrected before applying power to the set.

48. Operational Test

Operate the equipment as described in the equipment performance checklist (par. 32). This checklist is important because it frequently indicates the general location of trouble. Also listen for crackling or buzzing noises which indicate h-v arcing. Check the set for smoke and the odor of burned or overheated parts.

49. Trouble-shooting Chart

The following chart is supplied as an aid in locating trouble in the signal generator set. This chart lists the symptoms which the repairman observes,

either visually or audibly, while making a few simple tests. The chart also indicates how to localize trouble quickly to the audio oscillator, audio amplifier, r-f oscillator, and power supply stages. Once the trouble has been localized to a stage or a circuit, a tube check and voltage and resistance measurements of this stage or circuit should suffice to isolate the defective part. Normal voltage and resistance measurements are given in figure 15.

Symptom	Probable trouble	Correction
1. Heaters fail to light when power switch S2 is turned ON.	1. Fuse blown.	1. Replace F1. If it blows again, determine the fault before replacing.
	Transformer T2 winding open or shorted.	Make continuity tests of all transformer windings. Replace T2 if faulty.
	Defective switch S2.	Replace switch.
2. No deflection on RF OUTPUT meter M2.	2. Defective crystal CR4.	2. Replace crystal (par. 55).
	Defective tube V3.	Replace V3 (par. 54).
	Defective tube V7.	Replace V7.
	Loose contact on connectors, J1 or P1.	Tighten and clean.
3. No deflection on KC DEVIATION meter M1.	3. Defective tube V1.	3. Replace V1.
	Defective tube V2.	Replace V2.
		Use external modulation source to localize trouble at V1.
	Defective rectifiers CR1 or CR3.	Replace CR1 or CR3.
	Open capacitor C8.	Replace C8.
4. Regulator tube V6 fails to glow.	4. Defective rectifier CR2 .	4. Replace CR2.
	Defective regulator V6.	Replace V6.
	Shorted B- supply.	Localize by pulling V4 or V7 out of socket or by removing P1 from J1.
	Defective capacitor C20 or C21.	Replace C20 or C21.
	Defective coil L5.	Replace L5.
5. Pilot light E1 fails to light. All heaters light.	5. Faulty pilot light.	5. Replace E1.
6. Pilot light E1 fails to light. Heaters of tubes V4 and V7 fail to light.	6. Open 2-ampere winding of transformer T2.	6. Replace T2.
7. Cannot obtain full-scale deflection on M1 on HI range.	7. Defective V2.	7. Replace V2.
	Maladjustment of R17.	Readjust R17 (par. 60g).
8. Cannot obtain midscale setting of M2.	8. Defective V3.	8. Replace V3 (par. 54).
	Defective CR4.	Replace CR4.
	Reduced B† voltage.	Check B† voltage at V4 and V7.
	Defective R36.	Replace R36.
9. Erratic operation of M1.	9. Defective switch S1.	9. Clean contacts. If trouble persists, replace S1.
	Defective potentiometers R17 or R18.	Replace R17 or R18.
10. Meter M1 will not return to zero.	10. Defective V4, V5, or V6 causing parasitic oscillation in power supply.	10. Replace, one at a time, V4, V5, and V6.

50. D-c Resistances of Transformers

The d-c resistances of the transformer windings and the coils in the signal generator are listed below.

Transformer or coil	Terminals	Ohms
T1	2 leads	Less than .1 ohm
	2 solder lugs	Less than .1 ohm
T2	Black-black	5.9
	Red-white (center tap)	320
	Red-red	640
	Green-green (gray center tap not used)	.4
	Yellow-yellow	.4
L1	Coil ends	Less than .1 ohm
L2	Solder terminals	Less than .1 ohm
L3	Leads	35
L4	Leads	.14
L5	Leads	310

Section II. REPAIRS

51. Removing R-f Cavity from Panel

a. Remove the front nut which holds connector J3 to the panel (fig. 17). Withdraw connector from panel. Also unplug P1 from J1.

b. Remove MEGACYCLES ATTENUATION, and fine tuning knobs.

c. Remove r-f cavity cover by loosening the knurled screw between the cover and the clamp (fig. 16). Unhook the clamp from its pins and pull the cap off. If it will not come off easily, strike the side of the cap with the palm of the hand to loosen it.

CAUTION: Do not pry the cap off with a screw driver or any other tool; good contact at the edge of the cap and hence good shielding, depends on its not being bent or distorted.

d. Remove attenuator Z5 dial and shaft by loosening set screws in dial hub and gear (fig. 16).

e. Unsolder connection where r-f monitor loop is connected to the crystal contact.

f. Loosen the 1-inch nut which holds attenuator Z5 tube into the r-f cavity.

g. Rotate attenuator tube 90°, allowing it to clear cut-out in power supply bracket.

h. Remove the three large Philips screws on front pane which hold r-f cavity in place.

CAUTION: The cavity must be supported while doing this to avoid damage to the dial and moving-mask parts.

i. The r-f cavity may now be carefully removed from the panel, taking care that the dial mechanism is not damaged during removal. Be sure to disengage the pinch drive of the fine tuning control (fig. 21).

j. To reasemble, reverse above procedure.

Note.

Attenuator must be calibrated at reassembly (par. 61).

52. Dismantling R-f Cavity (fig. 21)

a. Remove clamp on main tuning shaft. This uncouples the tuning shaft from the dial.

b. Carefully unhook the moving mask from its spring and from its driving cord. Do not unfasten the cord unless the cord has broken. Reassembly is is much more difficult if the cord is unfastened from the differential drum.

c. Unscrew the dial screws and slide the dial off the shaft, taking care to collect all the toggle stops which rotate on the dial hub.

d. Remove one of the two screws holding the inner stop bracket to the casting so that the bracket can be moved out of the way of the ¾-inch nut under it.

e. Remove the ¾-inch nut which holds the main dial bearing in place.

f. Remove three mounting screws at the corners of the hexagonal gear plate (inside the cavity).

g. Disconnect cable from terminal strip.

h. Remove crystal CR4.

i. Disconnect heater lead (held by a nut underneath the tube socket).

j. Remove inside nut holding attenuator tube and withdraw attenuator from hole in casting. The No. 14 formex wire which forms the monitoring loop will have to be bent to clear the hole as it passes through.

k. The entire tuning mechanism can now be lifted out of the cavity.

l. To reassembe, reverse the above procedure.

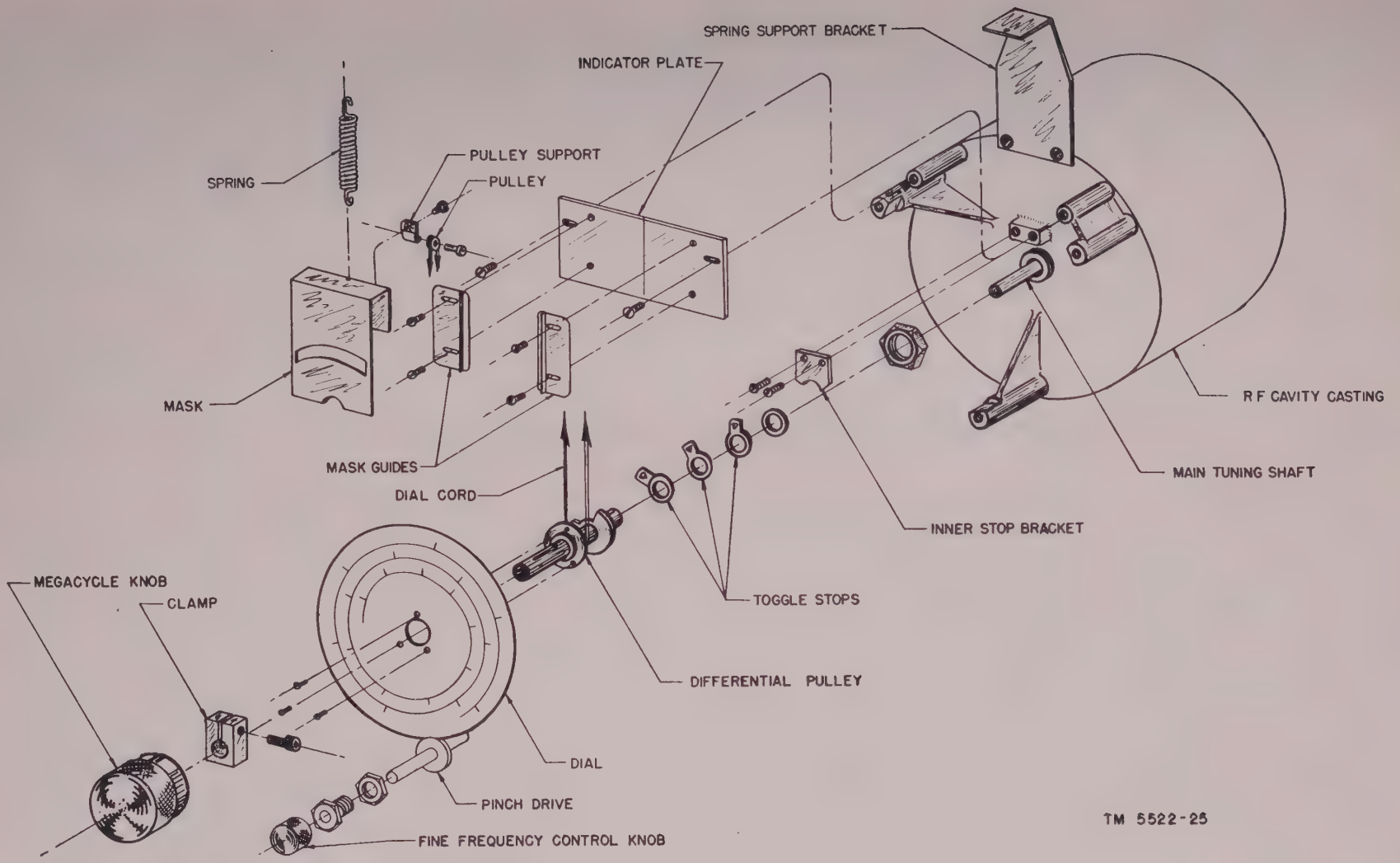


Figure 21. Signal Generator Set AN/URM-27, exploded view of dial assembly.

53. Rethreading Mask Cord Drive

a. Rotate the dial to the left against the stop. This is the high-frequency end of the tuning range (condenser plates unmeshed).

b. Completely remove the broken ends of the cable.

c. Insert one end of dial cord through the hole leading to the *small* drum. Fasten it securely at the front face of the drum.

d. Wrap five turns around the small drum in such a direction that the free end of the cord comes upward off the drum on the *left* side (as viewed from the panel side of the cavity).

e. Hook the sliding mask and its spring to the center hole of the spring support bracket.

f. Pass the cord over the mask pulley and wrap one-half turn around the large drum.

g. Thread the cord through the remaining hole and draw it taut until it begins to pull the mask downward against the spring tension. Be sure that the mask is sliding properly in its guides.

h. Carefully draw the cord through the hole until the baseline of the dial calibration is visible at the bottom of the mask opening.

i. Fasten the end of the cord securely at the front face of the small drum.

j. Operate the tuning dial to its extremes to make sure that the cord builds up properly and evenly on the drums. It may have to be guided initially to avoid getting snarled. If the cord does not progress in a smooth helix across the drum, the mask may move unevenly and the numbers on the dial may not be clearly visible through it at some places on the dial.

54. Removing R-f Oscillator Tube

The r-f oscillator tube may be removed from its socket without dismantling any of the units.

a. Loosen the knurled screw which presses the cavity cap against the r-f cavity.

b. Unhook the clamp from the pins in the side of the casting.

c. Remove the cap from the cavity. If the cap cannot be withdrawn easily, loosen it by bumping the side with the palm of your hand.

CAUTION: Do not pry off the cap with a screw driver or any other tool; good contact at the edge of the cap, and hence good shielding, depends on its not being bent or distorted.

d. The tube may now be withdrawn from its socket.

55. Removing R-f Crystal (CR4)

If the r-f output meter does not read even when there is evidence that the generator is delivering power to the output terminals, it is likely that the crystal is burned out and must be replaced. It should be noted that the output meter must be recalibrated for a new crystal in order to make the attenuator read correctly (par. 61).

56. Disassembling Tuning Mechanism

a. GENERAL. The tuning mechanism consists of the following principal parts:

(1) Tuning capacitor (C15).
(2) Variable inductor (L2).
(3) Modulation transformer (T1).
(4) Gear train.

The variable inductor and the modulator transformer are mounted on the capacitor frame which, in turn, is mounted on the gear plate. The gear plate, besides providing a rigid structure on which the gear bearings are mounted, provides a mounting for the whole assembly and, in turn, is fastened into the r-f cavity with three mounting studs.

b. REMOVING VARIABLE INDUCTOR. (1) Unscrew and remove spring clip and polystyrene block to which the clip is fastened.

(2) Unsolder the connections to the two terminals at the base of the inductor.
(3) Loosen the screw which clamps the rotating contact to the phenolic shaft, allowing the contact to slide along the shaft.
(4) Gently disengage the inductor from the square cut-out in its mounting bracket and slide inductor and contact off the end of the shaft.
(5) To reassemble, reverse the above disassembly procedure.

c. REMOVING MODULATION TRANSFORMER. (1) Disconnect primary leads from terminal strip by unsoldering them from the lugs.

(2) Disconnect r-f leads by unsoldering them from capacitor plates.
(3) Unscrew mounting screws which pass through iron core and spacers into the mounting bracket.
(4) Remove modulation transformer.
(5) To reassemble, reverse the above disassembly procedure.

d. REMOVING VARIABLE CAPACITOR. (1) Remove inductor and transformer as in subparagraphs b and c above.

(2) Remove plate and heater leads to tube socket.
(3) Loosen set screws which hold the potentiometer coupling to the end of the capacitor shaft.
(4) Remove screws from potentiometer bracket and remove potentiometer and bracket.

(5) Remove four mounting screws and spacers holding capacitor to gear plate.

(6) Remove capacitor from gear plate by sliding sideways until condenser gear clears the main tuning gear.

(7) To reassemble, reverse the above disassembly procedure.

e. DISMANTLING GEAR TRAIN. (1) Remove inductor, transformer, and capacitor as, in subparagraphs b, c, and d above.

(2) Remove inductor shaft bearing by removing three screws in the edge of the bearing flange.

(3) Withdraw the main tuning shaft from its bearing.

(4) Unscrew main shaft bearing from the gear plate.

(5) To reassemble, reverse the above disassembly procedure.

57. Refinishing

Instructions for refinishing badly marred panels on exterior cabinets are given in TM 9-2851.

Section III. CALIBRATION PROCEDURES

58. Test Equipment Required

The following test equipment is required for the alinement and calibration procedures:

a. Audio Oscillator TS-382A/U, 3F4325-382.

b. Frequency Meter TS-174/U, 3F4325-174.

c. Communications type a-m receiver, capable of receiving 10 and 20 mc, and having a beat frequency oscillator.

d. Bridge type power meter equivalent to Hewlett-Packard Model 430, including bolometer mount.

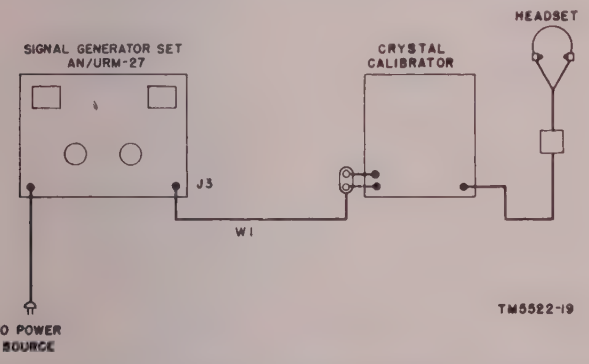


Figure 22. R-f oscillator frequency calibration, connection diagram.

59. R-f Oscillator Tuning Calibrations (fig. 22)

a. Compare a 10-mc crystal signal with station WWV transmission at 10 mc using communications receiver. Adjust crystal to zero beat or note the beat frequency and sign of difference.

b. Connect Signal Generator Set AN/URM-27 to crystal calibrator as illustrated in figure 22.

c. Rotate generator dial until zero beat is obtained in the neighborhood of 20 on the MEGACYCLES dial. If the mark on the dial corresponding to 20 mc does not fall on the hairline, remove the MEGACYCLES knob and loosen the clamp with a No. 8 Allen wrench. Using a screw driver inserted in the slot on the end of the tuning shaft to hold the tuning at zero beat, rotate the dial until the 20 mc mark is under the hairline. Retighten the dial on the shaft.

d. Move the MEGACYCLES dial up the scale noting the readings for successive harmonics of 10 mc (at 30, 40, 50 mc, etc., up to 100). The readings should all fall within .1 mc. If the readings become progressively higher or lower at the h-f end of the dial, adjust C14 to produce zero beat at a dial reading of 100 mc.

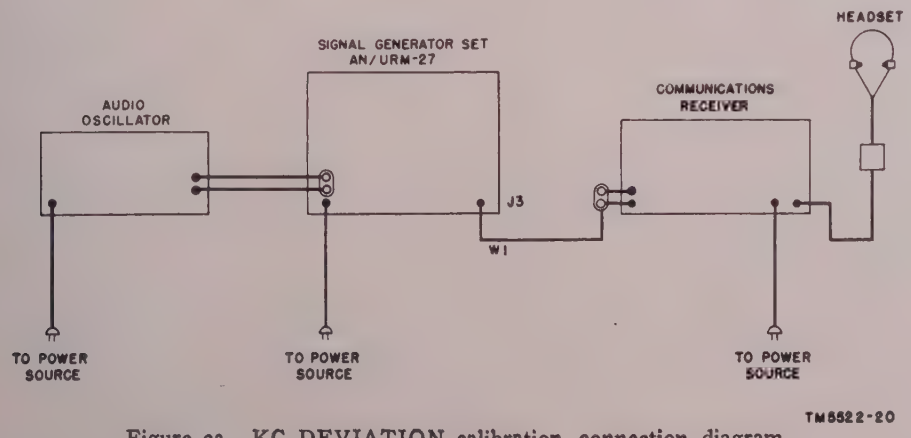


Figure 23. KC DEVIATION calibration, connection diagram.

60. KC DEVIATION Calibration

a. Connect output of Signal Generator Set AN/URM-27 to input of highly selective communications type receiver (fig. 23). Set generator modulation selector switch to EXT MOD and connect Audio Oscillator TS-382A/U to EXT MOD binding posts.

b. Adjust both signal generator set and receiver to 20 mc.

c. Adjust signal generator output to a level where the receiver output is audible and set the signal generator set DEVIATION control off (fully counterclockwise).

d. Adjust external audio oscillator for a modulating frequency of 5,000 cps.

e. Advance the signal generator DEVIATION control slowly clockwise and listen for dropouts of the carrier in the receiver.

f. The peak deviation at each dropout for 5,000 cps audio modulation will be:

Order of Dropout	*Peak Deviation KC*
1	12
2	27.6
3	43.3
4	58.9
5	74.7
6	90.35
7	106
8	121.5
9	137.5

g. The KC DEVIATION meter should be set to correspond to these deviation readings by adjustment of R18 and R17, in that order.

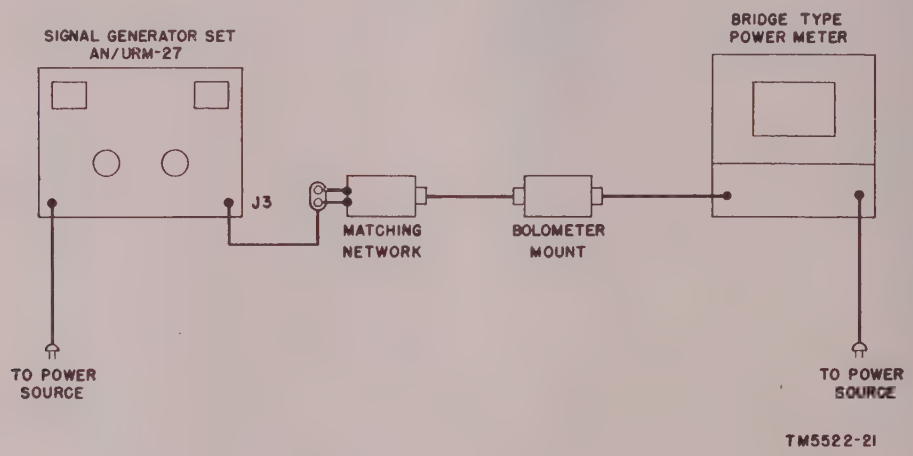


Figure 24. ATTENUATION output calibration, connection diagram.

61. ATTENUATION Output Power Calibration

This calibration must be performed whenever the attenuator assembly is removed and replaced.

a. Connect Signal Generator Set AN/URM-27 to a bridge type power meter, as illustrated in figure 24. Use a suitable matching network to transform impedance of bolometer unit to 50 ohms.

b. Turn the signal generator on and adjust to desired frequency.

c. Adjust METER SET control to center of its range, then set R36 so that RF OUTPUT meter pointer rests exactly on the red line.

d. Advance the ATTENUATION control knob clockwise until the output power meter indicates that the signal generator output is .20 mw into 50 ohms.

e. Loosen the set screws which hold the attenuator dial on the shaft and set the dial to read .1 volt. Do not move the shaft while loosening or tightening the dial.

f. Recheck the tuning of the signal generator, the zero adjustment of the power meter, and the attenuator dial setting.

Section V. FINAL TESTING

62. General

This section is intended as a guide to be used in determining the quality of a repaired test set. The minimum test requirements outlined in the following paragraphs may be performed by maintenance personnel with adequate test equipment and the necessary skills. Repaired equipment meeting these requirements will furnish uniformly satisfactory operation.

63. Test Equipment Required

The following test equipment is required for the alinement and calibration procedures:

a. Audio Oscillator TS-382A/U, 3F4325-382.

b. Frequency Meter TS-174/U, 3F4325-174.

c. Communications type f-m receiver.

d. Bridge type power meter equivalent to Hewlett-Packard Model 430, including bolometer mount.

64. Voltage and Resistance Tests

Check the voltage and resistance readings of the repaired test set against the values given in figure 15.

65. Final Testing Operations

To final test any repaired Signal Generator Set AN/URM-27, repeat the operations described in paragraphs 59, 60, and 61.

CHAPTER 6

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

66. Disassembly

Disconnect output cable and a-c power line.

67. Repacking for Shipment or Limited Storage

a. The exact procedure in repacking for shipment or limited storage depends on the material available and the conditions under which the equipment is to be shipped or stored. Reverse the instructions given in paragraph 10.

b. Whenever practicable, place a dehydrating agent such as silica gel inside the chest. Protect the chest with a waterproof paper barrier. Seal the seams of the paper barrier with waterproof sealing compound or tape. Pack the protected chests in a padded wooden case, providing at least 3 inches of excelsior padding or some similar material between the paper barrier and the packing case.

Section II. DEMOLTION OF MATERIAL TO PREVENT ENEMY USE

68. General

The demolition procedures outlined in paragraph 69 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only upon order of the commander.

69. Methods of Destruction

a. SMASH. Smash the controls, tubes, coils, switches, capacitors, transformers, and attenuator pads using axes, hammers, crowbars, or heavy tools.

b. CUT. Cut internal and external wires and cables using axes, knives, or machetes.

c. BURN. Burn cords, resistors, capacitors, coils, wiring, and technical manuals.

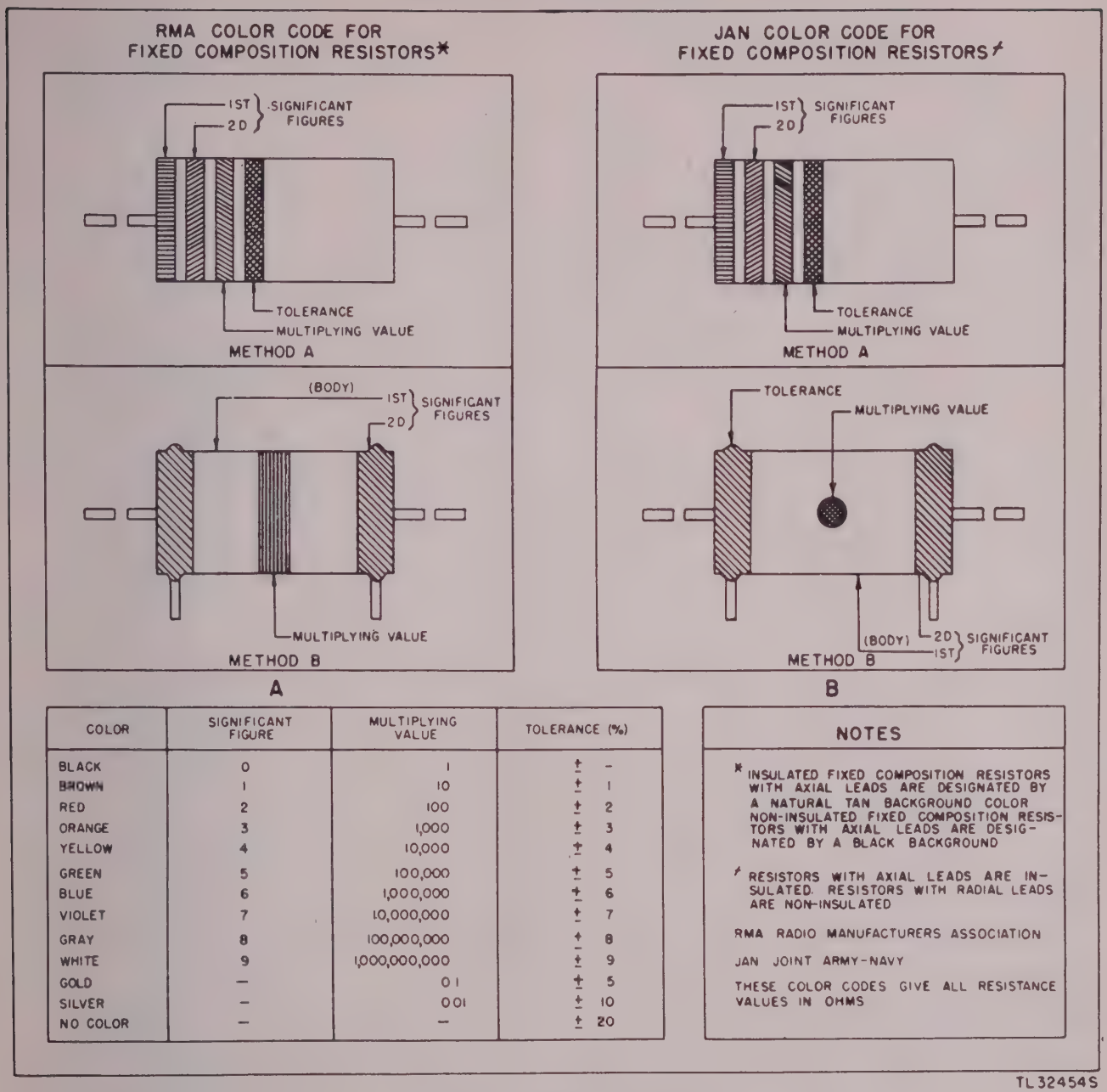
d. BEND. Bend panels and chassis.

e. EXPLOSIVES. If explosives are necessary, use firearms, grenades, or TNT.

f. DISPOSAL Bury or scatter the destroyed parts in slit trenches, fox holes, or other holes, or throw them into streams.

g. DESTROY EVERYTHING.

RESISTOR COLOR CODES



COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE	TOLERANCE (%)
BLACK	0	1	± –
BROWN	1	10	± 1
RED	2	100	± 2
ORANGE	3	1,000	± 3
YELLOW	4	10,000	± 4
GREEN	5	100,000	± 5
BLUE	6	1,000,000	± 6
VIOLET	7	10,000,000	± 7
GRAY	8	100,000,000	± 8
WHITE	9	1,000,000,000	± 9
GOLD	–	0 1	± 5
SILVER	–	0 01	± 10
NO COLOR	–	–	± 20

NOTES

* INSULATED FIXED COMPOSITION RESISTORS WITH AXIAL LEADS ARE DESIGNATED BY A NATURAL TAN BACKGROUND COLOR NON-INSULATED FIXED COMPOSITION RESISTORS WITH AXIAL LEADS ARE DESIGNATED BY A BLACK BACKGROUND

/ RESISTORS WITH AXIAL LEADS ARE INSULATED. RESISTORS WITH RADIAL LEADS ARE NON-INSULATED

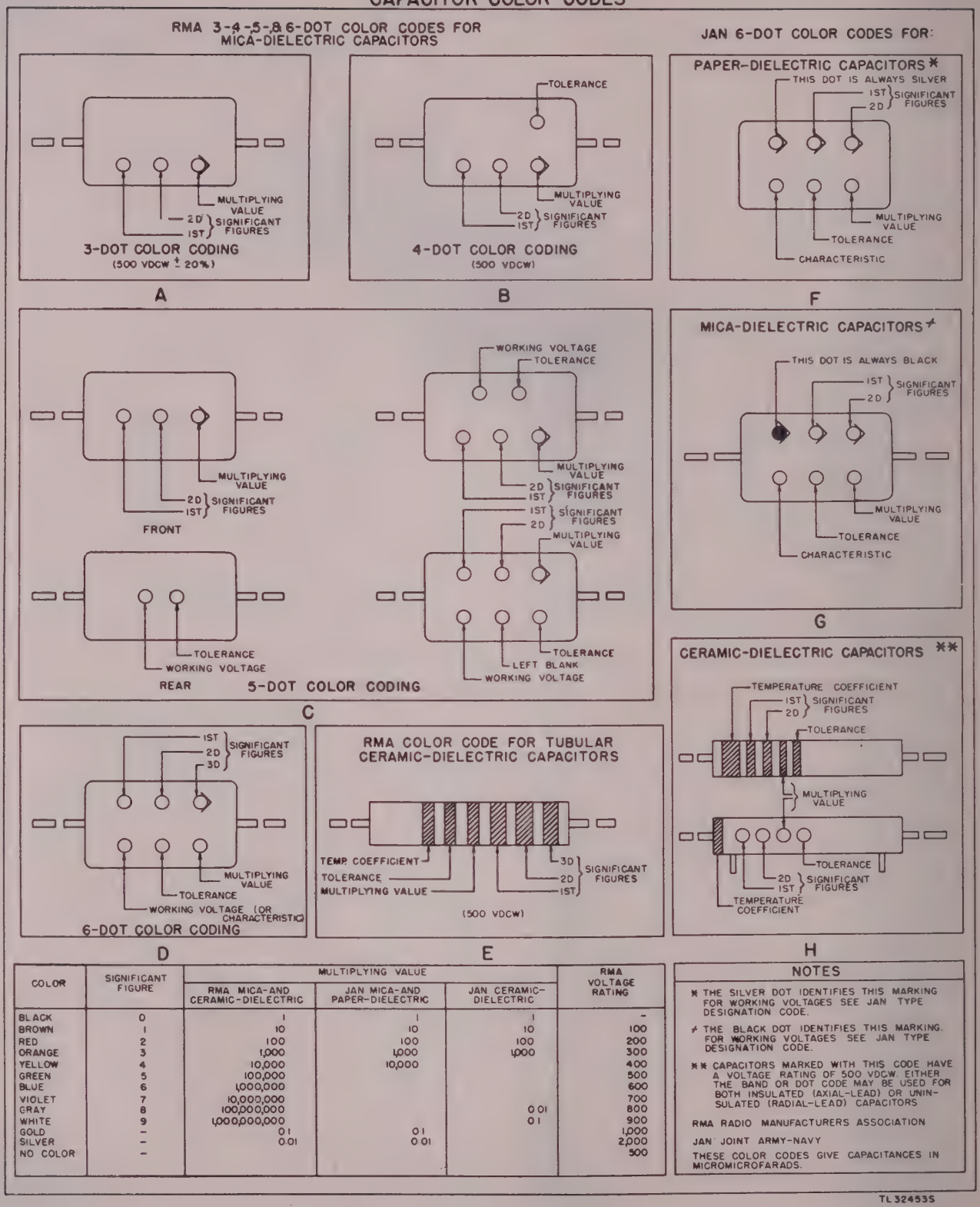
RMA RADIO MANUFACTURERS ASSOCIATION

JAN JOINT ARMY-NAVY

THESE COLOR CODES GIVE ALL RESISTANCE VALUES IN OHMS

TL 32454S

Figure 25. Resistor color codes.



COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE			RMA VOLTAGE RATING
		RMA MICA-AND CERAMIC-DIELECTRIC	JAN MICA-AND PAPER-DIELECTRIC	JAN CERAMIC-DIELECTRIC	
BLACK	0	1	1	1	-
BROWN	1	10	10	10	100
RED	2	100	100	100	200
ORANGE	3	1,000	1,000	1,000	300
YELLOW	4	10,000	10,000		400
GREEN	5	100,000			500
BLUE	6	1,000,000			600
VIOLET	7	10,000,000			700
GRAY	8	100,000,000		0.01	800
WHITE	9	1,000,000,000		0.1	900
GOLD	-	0.1	0.1		1,000
SILVER	-	0.01	0.01		2,000
NO COLOR	-				500

NOTES

* THE SILVER DOT IDENTIFIES THIS MARKING FOR WORKING VOLTAGES SEE JAN TYPE DESIGNATION CODE.

≠ THE BLACK DOT IDENTIFIES THIS MARKING. FOR WORKING VOLTAGES SEE JAN TYPE DESIGNATION CODE.

** CAPACITORS MARKED WITH THIS CODE HAVE A VOLTAGE RATING OF 500 VDCW. EITHER THE BAND OR DOT CODE MAY BE USED FOR BOTH INSULATED (AXIAL-LEAD) OR UNINSULATED (RADIAL-LEAD) CAPACITORS

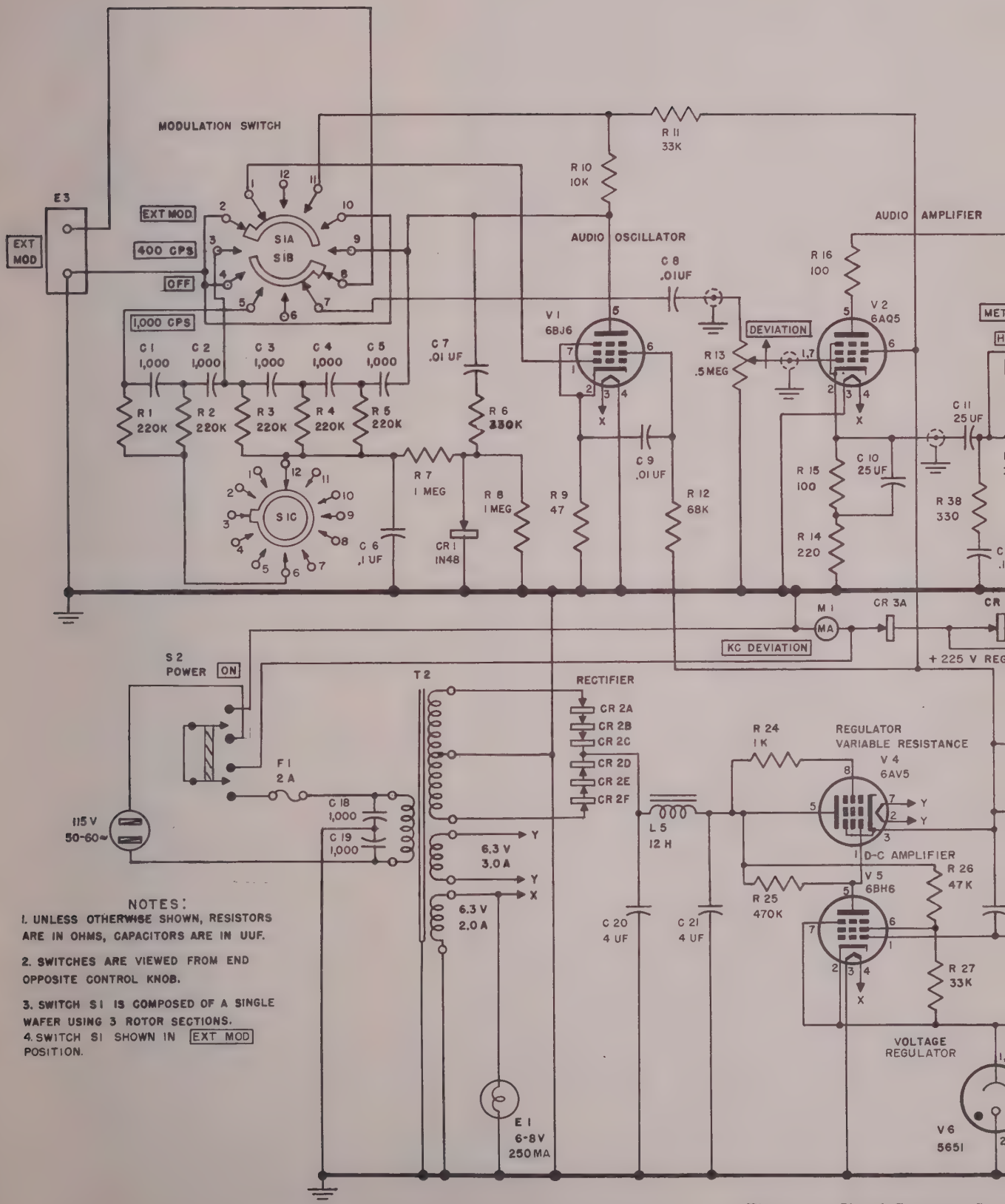
RMA RADIO MANUFACTURERS ASSOCIATION

JAN JOINT ARMY-NAVY

THESE COLOR CODES GIVE CAPACITANCES IN MICROMICROFARADS.

TL 32453S

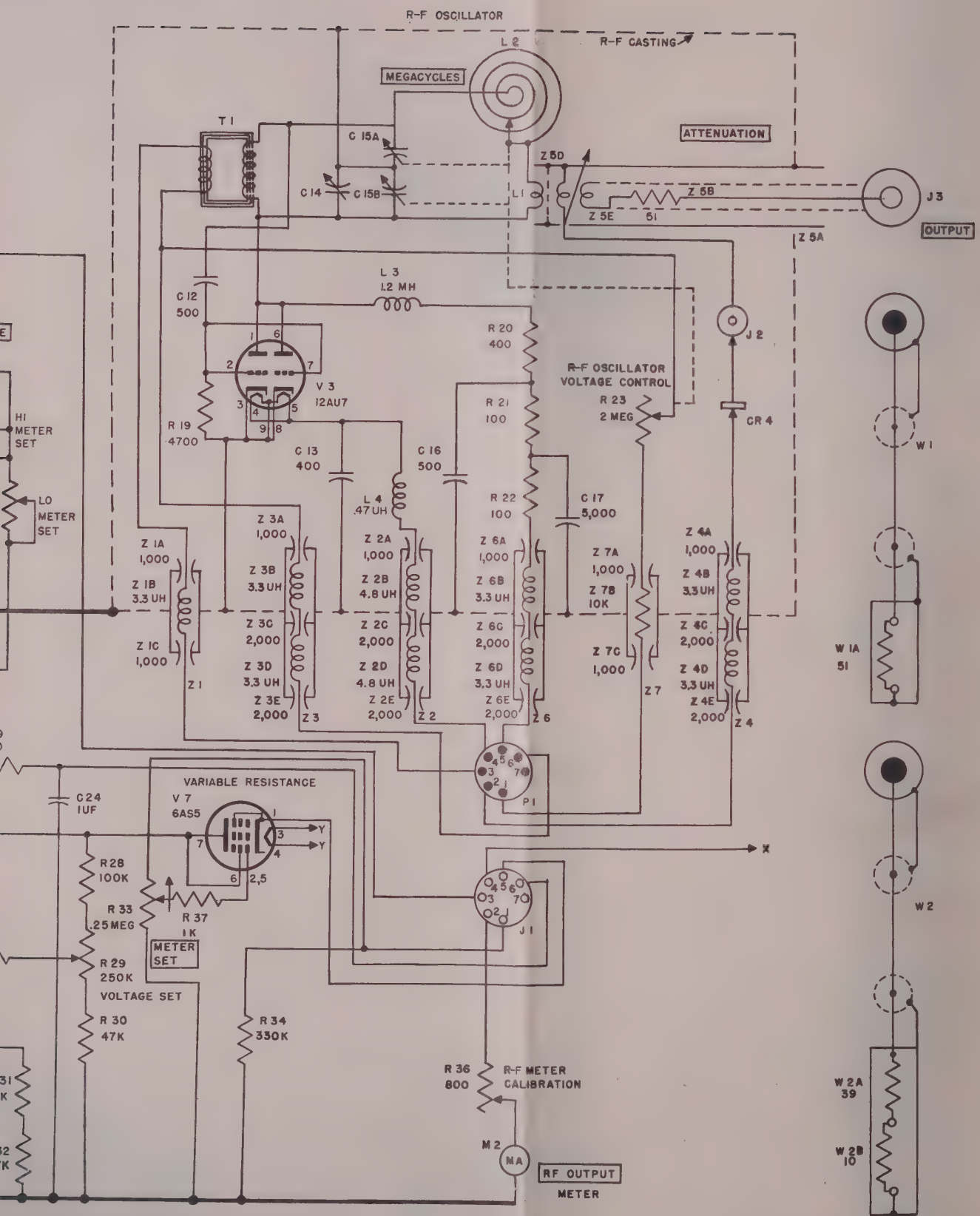
Figure 26. Capacitor color codes.



NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. SWITCHES ARE VIEWED FROM END OPPOSITE CONTROL KNOB.
3. SWITCH S1 IS COMPOSED OF A SINGLE WAFER USING 3 ROTOR SECTIONS.
4. SWITCH S1 SHOWN IN EXT MOD POSITION.

Figure 27. Signal Generator Set



M-27, schematic diagram.

TM 5522-24

APPENDIX I

REFERENCES

Note. For availability of items listed, check SR 310-20-3 and SR 310-20-4. Check Department of the Army Supply Catalog SIG 1 for Signal Corps supply catalog pamphlets.

1. Army Regulations

AR 380-5 Safeguarding Military Information.

2. Supply Publications

SIG 1	Introduction and Index.
SIG 3	List of Items for Troop Issue.
SIG 5	Stock List of All Items.
SIG 6	Sets of Equipment.
SIG 7&8	Organizational Maintenance Allowances and Field and Depot Maintenance Stockage Guide.
SIG 10	Fixed Plant Maintenance Lists.
SB 11-47	Preparation and Submission of Requisitions for Signal Corps Supplies.
SB 11-76	Signal Corps Kit and Materials for Moisture- and Fungi-Resistant Treatment.

3. Publications on Auxiliary Equipment and Test Equipment

TM 11-303, Test Sets I-56-C, I-56-D, I-56-H, and I-56 J.

TM 11-307, Signal Generators I-72-G, H, J, and K.

TM 11-321, Technical Manual for Test Set I-56-E.

TM 11-472, Repair and Calibration of Electrical Measuring Instruments.

TM 11-2613, Voltohmmeter I-166.

TM 11-2626, Test Unit I-176.

TM 11-2627, Tube Tester I-177.

4. Painting, Preserving, and Lubrication

TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment.

TM 9-2851, Painting Instructions for Field Use.

5. Camouflage

FM 5-20, Camouflage, Basic Principles.

6. Decontamination

TM 3-220, Decontamination.

7. Demolition

FM 5-25, Explosives and Demolitions.

8. Other Publications

FM 24-18, Field Radio Techniques.

FM 72-20, Jungle Warfare.

SR 700-45-5, Unsatisfactory Equipment Report (Reports Control Symbol CSGLD-247).

SR 745-45-5, NAV DEPT. SERIAL 85POO, AFR 71-4 — Report of Damaged or Improper Shipment (Reports Control Symbols CSGLD-66 (Army) SandA-70-6 (Navy), and AF-MC-U2 (Air Force).

SR 310-20-3, Index of Training Publications (Field Manuals, Training Circulars, Firing Tables and Charts, Army Training Programs, Mobilization Training Programs, Graphic Training Aids, Joint Army-Navy-Air Force Publications, and Combined Communications Board Publications).

SR 310-20-4, Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowances, Tables of Organization, Tables of Equipment, and Tables of Basic Allowances.

TB SIG 4, Methods for Improving the Effectiveness of Jungle Radio Communication.

TB SIG 25, Preventive Maintenance of Power Cords.

TB SIG 66, Winter Maintenance of Signal Equipment.

TB SIG 72, Tropical Maintenance of Ground Signal Equipment.

TB SIG 75, Desert Maintenance of Ground Signal Equipment.

TB SIG 123, Preventive Maintenance Practices for Ground Signal Equipment.

TB SIG 178, Preventive Maintenance Guide for Radio Communication Equipment.

TB SIG 223, Field Expedients for Wire and Radio.

TM 11-310, Schematic Diagrams for Maintenance of Ground Radio Communication Sets.

TM 11-453 Shop Work.

TM 11-455 Radio Fundamentals.

TM 11-466, Radar Electronic Fundamentals.

TM 11-486, Electrical Communication Systems Engineering.

TM 11-4000, Trouble Shooting and Repair of Radio Equipment.

TM 38-650, Basic Maintenance Manual.

9. Abbreviations

ac..... alternating current.
a-f..... audio-frequency.
cps..... cycles per second.
db..... decibels.
dc..... direct current.
fm..... frequency modulation.
h-v..... high-voltage.
kc..... kilocycles.
L-C..... inductance-capacitance.
mc..... megacycles.
mw..... milliwatts.
r-f..... radio-frequency.
μv..... microvolt.

APPENDIX II

IDENTIFICATION TABLE OF PARTS

1. Requisitioning Parts

The fact that a part is listed in this table is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as T/O&E, T/A, T/BA, SIG 7&8, SIG 7-8-10, SIG 10, list of allowances of expendable material, or another authorized supply basis. The Department of the Army Supply Catalog applicable to the equipment covered in this manual is SIG 7&8 AN/URM-27. For an index of available supply catalogs in the Signal portion of the Department of the Army Supply Catalog see the latest issue of SIG 1, Introduction and Index.

2. Identification Table of Parts for Signal Generator Set AN/URM-27

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	GENERATOR, RF: Army-Navy Signal Generator Set AN/URM-27(); FM; 18-109mc in 1 band; metal case w/carrying handles; 19⅜" lg x 12-5/16" wd x 12⅝" d o/a; better than 1%; 400 and 1000 cyc internal modulation; provision for external modulation; deviation adj 0-150 kc by front panel control and indicated on direct-reading meter; output attenuator calibrated in μv and db below 1 w into 50 ohms; operates from 115 v AC, 50-60 cyc line; includes output cable assem and instruction book; Dale Pollack type #100A.		3F3901.2-27
Z5	ATTENUATOR, variable: mutual inductance type; impedance 50 ohms ±15%; brass, silver pl, 6⅜" lg x 1¾" wd x 2¼" h o/a; logarithmic attenuator; range continuous from .1 μv to .1 v; 1 end terminated by Radio Frequency Cable RG-58A/U; mounts in 1" hole in osc casting, fastened with two 1"-32 nuts; calibrated dial plate; Dale Pollack part/dwg #EG8.	Varies output of generator.	2Z395.93
E3	BOARD, terminal: 2 brass nickel pl screw term; term on ¾" ctr; molded phenolic board; 1½" lg x ¾" wd x 1⅝" deep o/a; two ½" diam mtg holes on ¾" mtg/c; .110" wire holes in ea special term; Dale Pollack part/dwg #PB-1 for term; Dale Pollack part/dwg #EP-16 for insulators.	Binding post for EXT MOD input.	3Z770-2.85
E5	BOARD, terminal: 4 brass, nicke pl term; ⅜" between ctr of term, barrier between term; molded bakelite; 2-3/16" lg x⅞" wd x ⅜" h o/a; four .161" diam holes on 5/16" x 1-5/16" mtg/c; uses eight #5-40 x 3/16" binder head screws; Dale Pollack part/dwg #ET7.	Oscillator mounting board.	3Z770-4.104
W1	CABLE ASSEMBLY, RF: Army-Navy Radio Frequency Cable RG-58A/U; lg excluding terminations 3 ft; o/a lg of assem 3 ft 3"; terminated 1 end with Army-Navy Radio Frequency Plug UG-88/U connector, other end terminated in output box having 2 binding posts and a 51-ohm resistor; Dale Pollack part/dwg #WC3 for cable; Dale Pollack part/dwg #ET10 for output box.	R-f output cable.	3E5999A-4

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
W2	CABLE ASSEMBLY, RF: Army-Navy Radio Frequency Cable RG-58A/U; lg excluding term 3 ft; o/a lg of assem 3 ft. 3"; terminated 1 end with Army-Navy Radio Frequency Plug UG-88/U, other end terminated in output box containing one 39-ohm resistor and one 10-ohm resistor with Army-Navy Radio Frequency Plug UG-88/U; Dale Pollack part/dwg #WC3 for cable; Dale Pollack part/dwg #HA20 for output box.	R-f output cable.	3E7350-2.36.9
W3	CABLE ASSEMBLY, power: underwriters type SJ; two #18 AWG stranded cond, rubber insulation; 300 vdcw; cable rubber covered, jute filler; round, 5/16" diam; 6 ft lg excluding terminations; terminated 1 end by male plug molded to cable, no termination at other end; Dale Pollack part/dwg #WL2.	Power cord.	3E7350.1-72.30
C1 thru C5	CAPACITOR, fixed: mica; 1000 $\mu\mu$f $\pm$5%; 500 vdcw; JAN type CM30C102J.	Part of phase-shifting network for audio oscillator V1.	3K3010232
C6, C22, C23	CAPACITOR, fixed: paper dielectric; one sect; 100,000 $\mu\mu$f $\pm$20%; 400 vdcw; Aerovox type #P88; Dale Pollack part/dwg #CP1.	C-6: Avc filter capacitor for audio oscillator V1. C8: Grid coupling capacitor for V2. C22: Coupling capacitor.	3DA100-1053
C7, C9, C8	CAPACITOR, fixed: paper dielectric; 1 sect; 10,000 $\mu\mu$f $\pm$20%; 400 vdcw; Aerovox type #P88; Dale Pollack part/dwg #CP2.	C7: Avc blocking capacitor. C9: Screen bypass capacitor for V1.	3DA10-544
C10, C11	CAPACITOR, fixed: electrolytic; 1 sect; 25 μf; 50 vdcw; working temp range -20°C to+85°C; Dubilier type #BT50; Dale Pollack part/dwg #CB1.	C10: Cathode bypass capacitor for V2. C11: Isolating capacitor for deviation meter M1.	3DB25-121
C12	CAPACITOR, fixed: ceramic dielectric; 500$\mu\mu$f $\pm$20%; variable temp coef; 300 vdcw; Erie type #GP2K; Dale Pollack part/dwg #CX5.	Grid blocking capacitor for V3.	3D9500-242
C13	CAPACITOR, fixed: mica; 400 $\mu\mu$f; 300 vdcw; temp coef letter A; Erie type #370-EF; Dale Pollack part/dwg #CX3.	Filament bypass capacitor for V3.	3D9400-56
C14	CAPACITOR, variable: ceramic dielectric; screw type single sect; .5 to 3 $\mu\mu$f; 500 vdcw; Centralab type #7XA1482; Dale Pollack part/dwg #CX2.	R-f oscillator trimmer.	3D9003V-22
C15	CAPACITOR, variable: air dielectric; plate meshing type, 2 sect; first sect 9.1 to 304.2 $\mu\mu$f, second sect 9 to 156.5 $\mu\mu$f; SLF; .018" air gap; first sect, 17 aluminum plates .020" thk second sect, 9 aluminum plates .020" thk; 180 deg counterclockwise rotation to increase capacity; ceramic insulation; lug term; RCC series #23; Dale Pollack part/dwg #CV7.	Main tuning capacitor for r-f oscillator V3.	3D9304VE2
C16	CAPACITOR, fixed: ceramic dielectric; 500 $\mu\mu$f $\pm$20%; variable temp coef; 300 vdcw; Dale Pollack part/dwg #CX3.	Plate r-f decoupling capacitor for V3.	3D9500-243
C17	CAPACITOR, fixed: ceramic dielectric; 5000 $\mu\mu$f; 300 vdcw; Dale Pollack part/dwg #CX4.	Plate r-f decoupling capacitor for V3.	3DA5-227
C18, C19	CAPACITOR, fixed: mica; 1000 $\mu\mu$f $\pm$10%; 500 vdcw; JAN type CM30A102K.	A-c power input line filter.	3K3010211
C20, C21	CAPACITOR, fixed: paper dielectric; 1 sect; 4.0 μf +20% —10%; 600 vdcw; Sprague type #06P; Dale Pollack part/dwg #CP3.	Filter capacitors for power supply.	3DB4-369
Z1	COIL ASSEMBLY, RF: c/o RF filter case, RF choke coil, and mica capacitors, 1000 $\mu\mu$f $\pm$20%, 500 vdcw; RF choke coil 3.3 μh, 3 ohms DC resistance, 100 ma; 1¼" lg x ½" diam o/a; threaded ½"—27 at 1 end; Dale Pollack part/dwg #DA9-1.	Decouples r-f from modulator.	3C1084Z86

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
Z2	COIL ASSEMBLY, RF: c/o RF filter case, RF choke coils, mica capacitor, 1000 μμf ±20%; 500 vdcw, and mica capacitor, 2000 μμf ±20%, 500 vdcw; RF choke coil 4.8 μh, .25 ohms DC resistance, at .5 amp; 2½" lg x ¾" diam o/a; threaded ½"-27 at 1 end; Dale Pollack part/dwg #DA14.	Decouples r-f oscillator filament.	3C4030
Z3, Z4, Z6	COIL ASSEMBLY, RF: c/o RF filter case, RF choke coils, mica capacitor, 1000 μμf ±20%, 500 vdcw and mica capacitors, 2000 μμf ±20%, 500 vdcw, RF choke coil 3.3 μh, 3 ohms DC resistance, 100 ma; 2-½" lg x ¾" diam o/a; threaded ½"-27 a 1 end; Dale Pollack part/dwg #DA14.	Z3: decouples rf from modulator B+. Z4: decouples rf from output meter. Z6: decouples rf from oscillator.	3C4030-1
Z7	COIL ASSEMBLY, RF: c/o RF filter case, composition resistor (10,000 ohms ±20%, ½ w), mica capacitor, 1000 μμf ±20%, 500 vdcw; 1—¼" lg x ½" diam o/a; threaded ½"—27 at one end; Dale Pollack part/dwg #DA9-1.	Decouples grid of V7 from oscillator.	3F3901.2-27Y
L1	COIL, RF: single layer solenoid wnd; unshielded; 3 turns #14 e wire; ½" lg x ¼" wd rectangular coil; radial wire leads; self supporting; Dale Pollack part/dwg #LR18.	Tuning limit coil.	3C1081-55A
L2	COIL, RF: 1 wnd spiral wnd; unshielded; 6 spiral wnd turns; inductance range .025 μh to .985 μh; flat spiral 1-3/16" OD; 9/16" ID; molded phenolic form 1¾" diam x 3/16" wd; sliding cont tuning; 3/16" diam shaft through ctr of form; mounts in rectangular cut out 1" lg x ⅞" wd at bottom and 5/16" lg x 3/16" wd at top; 2 solder lug term at bottom; Dale Pollack part/dwg #LR16.	Oscillator variable inductor.	3C1081-54A
L3	COIL, RF: 3 universal wnd pies; unshielded; 1.2 mh at 1 mc, current rating 50 ma, DC resistance 35 ohms; ¾" lg x 5/16" diam o/a less term; phenolic form; 3/16" diam coil form; 2 pigtails 1⅜" lg; 1 axial tinned wire term ea end; Dale Pollack part/dwg #LR17.	Plate r-f choke for V3.	3C319J
L4	COIL, RF: single layer solenoid wnd; unshielded; .47 μh; ¾" lg x ¼" diam o/a; phenolic form; ¼" diam coil form; 2 pigtails 1⅜" lg; 1 axial tinned wire, term at ea end; covered with molded phenolic; Dale Pollack part/dwg #LR17.	Filament r-f choke for V3.	3C323-212C
J1	CONNECTOR, receptacle: 7 round female cont; straight; cylindrical, molded phenolic; standard miniature tube socket; ⅝" lg x ¾" diam; two 7/64" diam holes spaced ⅞" on mtg/c; Electro Connector Corp type #105PH-SP; Dale Pollack part/dwg #JM-3.	Power supply output connector to P1.	2Z3068-24
J2	CONNECTOR, female contact: 1 female cont, flat shape; straight type; 1" lg x ½" wd x 3/16" deep; rectangular body; ¼" diam opening; two 5/32" diam holes spaced ¼"; Dale Pollack part/dwg #JC3.	Crystal connector.	2Z3062-239
J3	CONNECTOR, receptacle: 1 female cont, sleeve shape; straight type; 1-1/16" lg x 15/32" diam o/a; 52 ohms impedance, constant with freq; cylindrical body, brass, silver pl; molded polystyrene insert; cable opening 5/16" diam threaded 15/32"-32, mounts with two 15/32"-32 nuts; includes cable grip; Dale Pollack part/dwg #JC2.	R-f output coaxial connector.	2Z3062-240
P1	CONNECTOR, plug: 7 round male cont; cylindrical steel shell, molded phenolic; standard miniature tube pins; ¾" OD x 1-1/16" lg less cont; mounts in standard miniature socket; metal shield; Dale Pollack part/dwg #PM1.	Power connector to J1.	2Z3027-30

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
CR1	CRYSTAL UNIT, rectifying: germanium; molded plastic case; peak inverse v, 85 v, continuous oper inverse v, 70 v, back resistance 60,000 ohms; forward current at +1 v, 4 ma; forward resistance 250 ohms; 11/32" lg x 13/64" diam o/a; 2 axial wire leads; marked IN48; GE type #IN48; Dale Pollack part/dwg #EK3.	Avc rectifier.	2JIN48
CR4	CRYSTAL UNIT, rectifying: silicon; ceramic tube w/brass erm gold pl; 3000 mc design freq, 6.5 db max conversion loss, output noise ratio 2.0 db max; 13/16" lg x 9/32" diam o/a; 1 plug term 3/16" lg x .093" diam, other term 3/16" lg x .246" diam; marked IN21B; Sylvania Prod type #IN21B; Dale Pollack part/dwg #EK2.	Rectifies r-f current for meter M2 indication.	2JIN21B
I1	DIAL: main tuning dial; c/o dial, tuning shaft, dial cord, mask, pulley, pulley support, springs, and mask support; 9/12" lg x 6" wd x 2" h o/a; dial shaft has single axial hole 3/8" diam, pegged to 3/8" diam shaft, mask support has two .173" mtg holes on 2 1/8" mtg/c; dial scale 18 to 109 mc; mask moves up and down as dial is turned; Dale Pollack part/dwg #ND13.	Megacycles tuning dial.	2Z3723-244
I2	DIAL: aluminum, flat white paint finish; 2 ranges; one 37 to 160 db below 1 w, other .1 μv to .1 v; disc shape; dial 5" diam x .062" thk, hub .612" lg x 1/2" diam o/a; 1/4" diam hub bore mtg fastened by two #6-32 set screws; marked ND9 on front of dial scale; figures printed in black on white background; Dale Pollack part/dwg #ND12.	Attenuation dial.	2Z3723-245
F1	FUSE, cartridge: 2 amp; 250 v; 1 time; glass body; ferrule term; 1 1/8" lg x 1/4" diam o/a; Littelfuse #312001; Dale Pollack part/dwg #FC2.	A-c power line fuse.	3Z1926
O6, O7	GEAR: spur type; brass; straight teeth; 108 teeth; pitch 48, pitch diam 2 1/4"; 2-5/16" outside diam x 3/8" bore x 1/16" thk; straight face; 2 gears spring loaded, 1 soldered to 3/8" diam shaft; Dale Pollack part/dwg #HC11-2.	O6: Capacitor drive gear. O7: Main tuning drive gear.	2Z4878-1261
O8	GEAR: pinion spur type; brass; straight teeth; 18 teeth; pitch 48, pitch diam 3/8"; 13/16" lg x 7/16" diam tapped axially #6-32 x 5/16" deep; straight face; 7/16" lg x .187" diam hub; pinned to drive shaft; Dale Pollack part/dwg #HC17.	Drives capacitor spur gear.	2Z4878-1259
O9	GEAR, spur type; brass; straight teeth; 48 teeth; pitch 48, pitch diam 1"; 1-1/16" outside diam x 1/4" bore x 1/8" thk; straight face; hub 1/4" lg x 1/2" diam; mounts on 1/4" shaft with #6-32 set screws; Dale Pollack part/dwg #HC11-3.	Variable coil drive gear.	2Z4878-1260
F4	HOLDER, fuse: extractor post type; black bakelite w/pl brass or copper cont and term; 125 v, 15 amp max; o/a dimen 2-17/64" lg x 11/16" diam; 1/2" diam threaded body for panel mtg; 2 solder lug term; Buss type #HKP; Dale Pollack part/dwg #FH1.	Holds and protects fuse, F1.	3Z3285-2
O1	KNOB: round; black enamel, aluminum; for 1/4" shaft; double #6-32 set screw; indicator dot; 7/8" diam x 9/16" h o/a; shaft hole 1/2" deep; counterbored 3/16" deep x 3/4" diam, coarse knurl; Dale Pollack part/dwg #HK10-1.	Indicator knob.	2Z5822-496
O2	KNOB: round; black enamel, aluminum; for 1/2" shaft; double #6-32 set screw; 1" lg x 2" diam o/a; shaft hole 3/8" deep; counterbored 7/16" lg x 1 3/4" diam, coarse knurl; Dale Pollack part/dwg #HK9.	Tuning knob.	2Z5822-497

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
O3	KNOB: round, black enamel, aluminum; for ¼" shaft; double #6-32 set screw; 1" lg x 2" diam o/a; shaft hole ½" deep; counterbored ¼" lg x 1¾" diam, coarse knurl; Dale Pollack part/dwg #HK9.	ATTENUATION CONTROL knob.	2Z5822-498
O4, O5	KNOB: round; black enamel, aluminum; for ¼" shaft; double #6-32 set screw; 9/16" lg x ⅞" diam o/a; shaft hole ½" deep; counterbored 3/16" lg x ¾" diam, coarse knurl; Dale Pollack part/dwg #HK10.	O4: DEVIATION control knob. O5: METER SET control knob.	2Z5822-499
E1	LAMP, incandescent: 6-8 v, .25 amp; bulb T-3-¼ clear; 1⅛" lg o/a; miniature bayonet base; tungsten fil; burn any position; GE type #44; Dale Pollack part/dwg #EA1.	Power indicator lamp.	2Z5927
E2	LIGHT, indicator: with lens; ½" diam red lens, smooth frosted all over; miniature bayonet base; open frame; nickel pl steel shell; 1¾" lg x ⅞" h x 1" deep; requires 11/16" mtg hole max panel thk ¼"; socket horizontally mtd, pilot lamp replaceable from front panel; threaded jewel; 2 solder lug term at base of socket; Dialco type #810B-43; Dale Pollack part/dwg #JS8.	Holds pilot lamp.	2Z5991-54
M1	METER, arbitrary scale: DC; range 0 to 1 ma; square plastic flush mtg case; barrel diam 2¾", depth behind flange excluding term 1", square flange 3" h x 3" wd o/a; accuracy ±2% of full-scale reading; D'Arsonval movement; current required for full-scale deflection 1 ma, resistance of movement 55 ohms; calibrated for nonmagnetic panel; 2 scales, 1 reading 0 to 30 kc, other reading 0 to 150 kc; self-contained; four #4-36 mtg holes on 2¼" x 2¼" mtg/c, 1 hole 2-25/32" diam centered on mtg/holes; 2 stud term ¼"-28 thread, ⅝" lg; scale marking "KILOCYCLES"; Triplett DC model #327-T; Dale Pollack part/dwg #M4.	KC DEVIATION meter.	3F3310-6
M2	METER, arbitrary scale: DC; range 0 to 1 ma; square plastic flush mtg case; barrel diam 2¾", depth behind flange excluding term 1", square flange 3" h x 3" wd o/a; accuracy ±2% of full-scale reading; D'Arsonval movement; current required for full-scale deflection 1 ma, resistance of movement approximately 55 ohms; calibrated for nonmagnetic panel; 1 red scale division in ctr of scale on white background; self-contained; four #4-36 mtg holes on 2¼" x 2¼" mtg/c, 1 hole 2-25/32" diam centered on mtg-holes; 2 stud term ¼"-28 thread, ⅝" lg; scale marking "SET TO RED LINE"; Triplett DC model #327-T; Dale Pollack part/dwg #M3.	RF OUTPUT meter.	3F3312-9.1
L5	REACTOR: 1 sect; 12 hy, 80 ma; 375 ohms DC resistance; 2000 v RMS test; open frame; 3¼" lg x 2" wd x 2" h; two .216" holes in ft, 2⅞" mtg/c; 2 wire leads on side; tropicalized; Dale Pollack part/dwg #LF2.	Filter choke for power supply.	3C570-17
CR2A thru CR2F	RECTIFIER, metallic: selenium; max AC input v 130 v RMS, 60 cyc; output v 125 v DC at 65 ma w/40 ∧f input filter capacitor; rectangular, 1" wd x 1" h x ¾" d o/a less term, 2 lug type term extend 19/64" on 1 side; one 5/32" diam mtg hole; Fed Tele & Rad type #402D3452A; Dale Pollack part/dwg #EK1.	Power rectifiers.	3H4860-103
CR3A, CR3B	RECTIFIER, metallic: copper oxide; input 6 v AC, no freq limit; output 5 v DC, 2.5 ma DC half wave continuous; ½" lg x ¼" wd x ⅜" d, excluding leads; one 7/64" diam mtg hole; Bradley Lab type #CX14E2D; Dale Pollack part/dwg #EW1.	Rectify a-f modulation voltage for meter M1.	3H4838-15.5
R1 thru R5	RESISTOR, fixed: comp; 220,000 ohms ±5%; ½ w; JAN type RC20BF224J.	Part of phase shifting network for audio oscillator V1.	3RC20BF224J

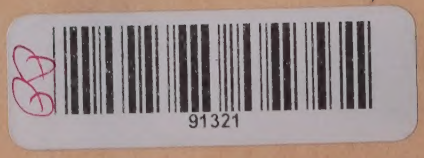
Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R6, R34	RESISTOR, fixed: comp; 330,000 ohms ±5%; ½ w; JAN type RC20BF154J.	Oscillator avc voltage divider.	
R7, R8	RESISTOR, fixed: comp; 1 meg ±10%; ½w; JAN type RC20BF105K.	R7: Oscillator avc filter resistor. R8: Oscillator avc voltage divider.	3RC20BF105K
R9	RESISTOR, fixed: comp; 47 ohms ±10%; ½w; JAN type RC20BF470K.	Cathode bias resistor for V1.	3RC20BF470K
R10, R35	RESISTOR, fixed: comp; 10,000 ohms ±20%; ½w; JAN type RC20BF103M.	R10: Plate load for V1. R35: Grid resistor for V5.	3RC20BF103M
R11, R27	RESISTOR, fixed: comp; 33,000 ohms ±20%; ½ w; JAN type RC20BF333M.	R11: Plate load voltage divider for V1. R27: Screen voltage divider for V5.	3RC20BF333M
R12	RESISTOR, fixed: comp; 68,000 ohms ±20%; ½w; JAN type RC20BF683M.	Screen voltage-dropping resistor for V1.	3RC20BF683M
R13	RESISTOR, variable: comp; 500,000 ohms ±20% 2 w; JAN type RV4AYFD504D.	DEVIATION control.	3RV55045
R14	RESISTOR, fixed: comp; 220 ohms ±10%; ½w; JAN type RC20BF221K.	Cathode bias resistor for V2.	3RC20BF221K
R15, R39 R16, R21, R22	RESISTOR, fixed: comp; 100 ohms ±10%; ½ w; JAN type RC20BF101K.	R15: Cathode bias resistor for V2. R16: Parasitic suppressor for plate circuit of V2. R21 and R22: Plate circuit decoupling resistors for V3.	3RC20BF101K
R17	RESISTOR, variable: WW; 3000 ohms ±20%; 1.5 w at 40°C; 1 solder lug term; ⅜" lg x 1" diam; two .136" mtg holes on 1" mtg/c; Dale Pollack part/dwg #RV5.	HI METER RANGE set control.	3Z7330-33
R18, R36	RESISTOR, variable: WW; 800 ohms ±20%; 1.5 w at 40°C; 1 solder lug term; 1" diam x ⅜" deep; two .136" mtg holes on 1" mtg/c; Dale Pollack part/dwg #RV6.	R18: LO METER RANGE set control. R:36: RF OUTPUT meter calibration resistor.	3Z7280-2
R19	RESISTOR, fixed: comp; 4700 ohms ±10%; ½ w; JAN type RC20BF472K.	Grid resistor for V3.	3RC20BF472K
R20	RESISTOR, fixed: comp; 391 ohms ±20%; ½ w; JAN type RC20BF391K.	Plate circuit decoupling resistor for V3.	3RC20BF391K
R23	RESISTOR, variable: comp; 2 meg ± 20%; 2 w; JAN type RV4AYFD255B.	R-f oscillator V3 output voltage stabilizing control.	3RV62520
R24, R37	RESISTOR, fixed: comp; 1000 ohms ±20%; ½ w; JAN type RC20BF102M.	R24: Screen-dropping resistor for V4. R37: Screen-dropping resistor for V7.	3RC20BF102M
R25	RESISTOR, fixed: comp; 470,000 ohms ±10%; ½ w; JAN type RC20BF474K.	Plate load resistor for V5.	3RC20BF474K
R26, R30, R31, R32	RESISTOR, fixed: comp; 47,000 ohms ±20%; ½ w; JAN type RC20BF473M.	R26: Screen voltage divider for V5. R30: Grid voltage divider for V5. R31 and R32: Regulator voltage dividers for V6.	3RC20BF473M
R28	RESISTOR, fixed: comp; 100,000 ohms ±20%; ½ w; JAN type RC20BF104M.	Grid voltage divider for V5.	3RC20BF104M
R29	RESISTOR, variable: comp; 250,000 ohms ±20%; 2 w; JAN type RV4AYSC254B.	Voltage set control.	3RV52530
R33	RESISTOR, variable: comp; .25 Meg. ±20%; 2 w; JAN type RV4AYFD254B.	RF OUTPUT METER SET resistor.	
R34	RESISTOR, fixed: comp; 120,000 ohms ±20%; ½ w; JAN type RC20BF124K.	Grid resistor for V7.	3RC20BF124K
X1, X2, X3, X5, X6, X7	SOCKET, tube: 7 pin miniature; 1 piece saddle under chassis mtg; two .093" diam mtg holes on ⅞" mtg/c; round, mica filled bakelite body ¾" diam x 25/64" h excluding term; phosphor bronze silver pl cont; without metal shock shield and without ctr shield; bottom mtg; Electro Connector Corp type #105PH-SP; Dale Pollack part/dwg #JS6.	Tube sockets for V1, V2, V3, V5, V6, and V7.	2Z8677.158

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
X4	SOCKET, tube: octal; 1 piece saddle under chassis mtg; two .140" diam holes on 1-5/15" holes mtg/c; round black bakelite body, 1⅛" diam x ½" h excluding term; phospher bronze silver pl cont; without metal shock shield and without ctr shield; bottom mtg; None Cinch #9920; Dale Pollack part/dwg #JS7.	Tube socket for V4.	2Z8670.19
S1	SWITCH, rotary: 3 pole 4 position; 1 sect; silver pl brass; bakelite body; 1⅞" diam x ⅞" lg body; shorting cont; indexed for 30 deg per throw; solder lug term; Dale Pollack part/dwg #SH12.	Modulation switch.	3Z9825-62.45
S2	SWITCH, toggle: DPDT; JAN type ST22K.	Power ON switch.	
S3	SWITCH, toggle: SPST; JAN type ST10A.	METER RANGE HI-LO switch.	3Z9863-10A
T1	TRANSFORMER, variable RF; 2 wnd, 1 single layer, 1 multiple layer; unshielded; single layer wnd 26 turns #38 formvar, multiple layer wnd 750 turns #30 formvar; o/a length 1⅝", o/a width 1¼" mod coil 1" diam, RF coil ⅛" diam laminated iron "U" core closed with powdered iron core; coil form for mod coil 3/16" lg x 5/16" wd, coil form for RF coil ⅛" diam; turned by variations of permeability of core; adjusted by current variations through modulating coil; two .180" diam mtg holes on 2" mtg/c; 2 solder lug term on RF coil and two 4" lead term on modulating coil; Dale Pollack part/dwg #TR1, #LT-3.	Variable inductance transformer.	2Z9629-300
T2	TRANSFORMER, power: fil and plate type; pri (black-black) input 115 v, 60 cyc, single phase; 3 output wnd; secd #1 (red-white-red), 720 v at 70 ma CT; secd #2 (green-slate-green), 6.3 v at 3 amp CT; secd #3 (yellow-yellow), 6.3 v at 1.5 amp; 1600 v insulation; impr with fungusproof lacquer per JAN-C-173; enclosed metal case; 3" lg x 2½" wd x 2½" h; 10 wire lead term on bottom; four .180" diam holes on 2" x 2½" mtg/c; tropicalized per JAN-C-173; Thordarson type #T-22R02 5 v, 2 amp wnd changed to 6 v, 1.5 amp 300-0-300 v uniting to 360-0-360 v; Dale Pollack part/dwg #TP12.	Power and filament transformer for power supply.	2Z9613.705
V2	TUBE, electron: RMA #6AQ5; pentode.	Audio amplifier.	2J6AQ5
V3	TUBE, electron: RMA #12AU7; dual triode.	R-f oscillator.	2J12AU7
V4	TUBE, electron: RMA #6AV5; pentode.	Series-regulator tube.	2J6AV5
V5	TUBE, electron: RMA #6BH6; pentode.	Voltage-regulator control tube.	2J6BH6
V6	TUBE, electron: RMA #5651.	Voltage regulator.	2J5651
V7	TUBE, electron: RMA #6AS5.	Series-regulator tube for oscillator.	2J6AS5
R38	RESISTOR, fixed: comp. 330 ohms ± 10%; ½ W: JAN type RC203F331K.	Meter compensation.	
C24	CAPACITOR, fixed: paper dielectric, 1 sect; 1.0 μf± 20%; 400 vdcw; Aerovox type 430; Dale Pollack part/dwg #CP-4.	Decoupling capacitor for power supply.	

INDEX

	Paragraph	*Page*
Block Diagram	33	16
Calibration Procedure:		
MEGACYCLES Oscillator Tuning calibration	59	37
KC DEVIATION calibration	60	38
ATTENUATION Output power calibration	61	38
Cleaning and inspection	25	12
Controls and their functions	14	7
Crystal CR_4, removal and replacement	55	36
Demolition	69	40
Description of equipment	7,8	5
Dial drive	53	36
Equipment performance checklist	32	14
Final testing	62, 63, 64, 65	39
Forms	2	1
Gear train	56	36
Identification table of parts	app. II	45
Installation	11	6
Lubrication	26	13
Mask drive, rethreading	53	36
Modulation switch, theory	38	21
Madulation transformer, removing	56	36
Operation	15, 16, 17	9
Operation under unusual conditions:		
Arctic climate	19	11
Tropical climate	20	11
Desert	21	11
Organizational preventive maintenance:		
Tools and materials	22	12
Definition of preventive maintenance	23	12
Preventive maintenance techniques	24	12
Performing preventive maintenance	25	12
Output attenuator, theory	37	21
Packaging data	5	3
Power supply test	47	30
Purpose and use	3	1
Rectifier and filter, theory	39	22
References	app. I	43
Repairs	51 to 57	34
R-f cavity, dismantling	52	34
R-f cavity, removal	51	34
R-f crystal, removal	55	36
R-f oscillator, theory	36	19
R-f oscillator tube, removal	54	36
Rustproofing and painting	28	13
Schematic diagram	fig. 27	13
Scope	1	1

	Paragraph	Page
Service upon receipt	9, 10, 11, 12	6
Siting	9	6
Special tools required	22	12
Starting procedure	15	9
Technical characteristics	4	2
Test equipment required for trouble shooting	45	29
Theory:		
OUTPUT attenuator	37	21
Audio amplifier	35	19
Audio oscillator	34	18
Block diagram	33	16
R-f oscillator	36	19
Modulation selector switch	38	21
Selenium rectifier	39	22
Voltage regulator	40	23
Variable resistance	41	24
R-f cables	42	26
Trouble-shooting data	44	28
Tuning mechanism, disassembly	56	36
Unpacking, uncrating, and checking	10	6
Visual inspection	30	14
Voltage regulator, theory	40	23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